# THE NEGLECTED ROLE OF
# SCHOOL DISTRICT REVENUE INSTABILITY:
# MEASUREMENT, CAUSES AND RESPONSES

A DISSERTATION

SUBMITTED TO THE SCHOOL OF EDUCATION

AND THE COMMITTEE ON GRADUATE STUDIES

OF STANFORD UNIVERSITY

IN PARTIAL FULFILLMENT OF THE REQUIREMENTS

FOR THE DEGREE OF

DOCTOR OF PHILOSOPHY

REKHA BALU

JUNE 2011

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**Susanna Loeb, Primary Adviser**

I certify that I have read this dissertation and that, in my opinion, it is fully adequate in scope and quality as a dissertation for the degree of Doctor of Philosophy.

**Eric Bettinger**

I certify that I have read this dissertation and that, in my opinion, it is fully adequate in scope and quality as a dissertation for the degree of Doctor of Philosophy.

**David Plank**

Approved for the Stanford University Committee on Graduate Studies.

**Patricia J. Gumport, Vice Provost Graduate Education**

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# THE NEGLECTED ROLE OF SCHOOL DISTRICT REVENUE INSTABILITY: MEASUREMENT, CAUSES AND RESPONSES

Rekha Balu, Ph.D.
Stanford University, 2011

Reading Committee Member: Susanna Loeb

Much of the school finance literature has focused on the distribution or equality of resources across school districts. Such literature compares levels of spending between school districts or states. But it has ignored the variability and unpredictability of those revenues within school districts over time. Meanwhile, public finance literature has focused on states or counties, and disregarded school districts as a unit of analysis for responses to fiscal stress. This dissertation addresses these gaps.

First, drawing from techniques both within and outside of public finance, I contribute a new measure of fiscal stress based on unpredictability of state revenues. Second, I explicitly assess policy and tax mechanisms that may aggravate revenue instability for school districts and to what extent instability changes over time. Finally, I examine school districts response to chronic unpredictability in state revenues.

Despite states' increasing reliance on more volatile sales and income taxes to fund public education, I find that unpredictability in state revenues to districts has declined by one-fourth of a standard deviation over time. In states that shifted to the more volatile sales and income tax base while also centralizing school finance as part of efforts to equalize school funding, unpredictability in state revenues to districts declined by a full standard deviation. In effect, centralization and more equal distribution of funding appears to trump the effects of a volatile tax base, as states have a greater ability to buffer against shocks than local education agencies do.

Yet districts still face uncertain and unstable revenues from the states, aggravated by economic downturns. With primary and secondary data, I study the case of California where districts face uncertain cuts to their allocations during the year and between years. I use three key fiscal health measures: average revenue instability over time, whether revenues declined in the prior period, and the experience of the budget officer. I find that highly unstable districts are more likely to raise local revenues, but that cost-cutting is more prevalent that revenue-raising. Experienced budget officers use a greater variety of policy instruments to cope with instability, pointing to the under-explored role of management in the fiscal health of a district.

These findings as a whole suggest that revenue instability merits further attention in the school finance literature in particular and public management in general. Unpredictability in states revenues is a phenomenon that concerns school districts, one that changes over time, but one to which they may adapt.

# ACKNOWLEDGMENTS

This dissertation would not be possible without the guidance of great minds and support of many kind hearts. Susanna Loeb and Eric Bettinger provided thoughtful feedback on modeling and estimation, and invaluable direction for the dissertation. Their advice on how to discuss complicated issues in simple terms, and their example of productivity, serve as a beacon for me and untold others. I owe a large debt of gratitude to Martin Carnoy and Susanna Loeb for championing my ideas from the beginning to the end of this intellectual journey.

I would like to thank several faculty members who taught instrumental graduate economics courses that informed my work: Caroline Hoxby, Avner Greif, Nicholas Bloom, and Luigi Pistaferri. Grant Miller proved a model teacher, one I hope to emulate in the future.

The final essay would not be possible without participation of many school district budget officers, in California and other states, who spared time for interviews and my survey during a hectic and critical period for their districts. In addition, EdSource kindly shared their data from a comparable 2006 survey. The California Department of Education's Fiscal Services division provided timely and helpful explanations of how best to use the public accounting code data.

I appreciate the generous and thoughtful feedback from the stellar collection of scholars who read my conference papers at the annual meetings of the Society of Research on Educational Effectiveness, the Association for Education Finance and Policy, and the American Educational Research Association. Support from the

Association for Education Finance and Policy Pre-Doctoral Award helped me complete the final stages of the dissertation.

My peers proved indispensible, as they listened to nascent ideas and provided feedback at various stages of the dissertation when I encountered difficulty. They are (in alphabetical order): Allison Atteberry, Patricia Bromley, Steven Buck, Rafael Carrasco, Johane Eliacin, Brent Evans, Heather Hough, Daniel Klasik, Daniel Kreiss, Charlotte Lee, Maria Perez, and Zhanara Nauruzbayeva. Whether editing an unclear sentence, solving an equation or coding problem, or simply lending an ear when I needed to clarify a thought, they kept me and my dissertation moving forward. Jillian Hess, Erin Pettigrew, Ann Richman, Rachel Stein, and Ling Yang provided excellent perspective on what it means to be a scholar.

One person deserves special mention for serving as coach, reviewer, proofreader and life preserver: Paul Wassenich. Without his encouragement to pursue the underlying ideas in this dissertation, and his willingness to talk through thorny questions at all hours, I would not have reached the finish line. Finally, I cannot do justice to the constancy and purity of my parents' support of and faith in me. This dissertation, in many ways, is for them.

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Much of school finance literature has focused on the distribution or equality of resources across school districts. Such literature compares levels of spending between school districts or states (Hoxby 2001; Evans, Murray & Schwab, 1998). But it has ignored the variability and unpredictability of those revenues within school districts over time. This gap in the literature is curious, given the growing number of empirical studies on fiscal stress in state and local governments and the growing difficulty states have in forecasting revenues (Clemens 2011; Boyd et al., 2011). Policymakers and researchers have little evidence about how school districts—the stewards of billions of dollars of public education funds—are coping with *both* episodic declines in state revenues as well long-term unpredictability. Some of this unpredictability stems from the structure of state financing of education. If the tax base for education is unstable or unpredictable, then revenues for school districts may be unstable over the long-run as well. And if a district cannot predict whether it will have the same revenues three years from now as it does today, it may be unable to sustain large-scale policy reforms, retain teachers, and ultimately improve student achievement.

Revenue instability may be a key but neglected factor for the ongoing question in public education regarding 'does money matter.' Despite mixed evidence on whether the *quantity* of per-pupil revenues and spending affect student achievement we know little about whether *stability* or predictability of districts' revenues matters. Stability is an under-studied channel through which resources map to school outcomes. But to date, no one has measured unpredictability in state revenues to test this intuition. It is possible that unpredictability (unexpected variation) in state aid to school districts is interacting with spending levels or program implementation in a way that weakens the link between

resources and student achievement. In addition, if some types of districts are more revenue-unstable than others, instability raises equity issues that may concern policymakers and researchers alike.

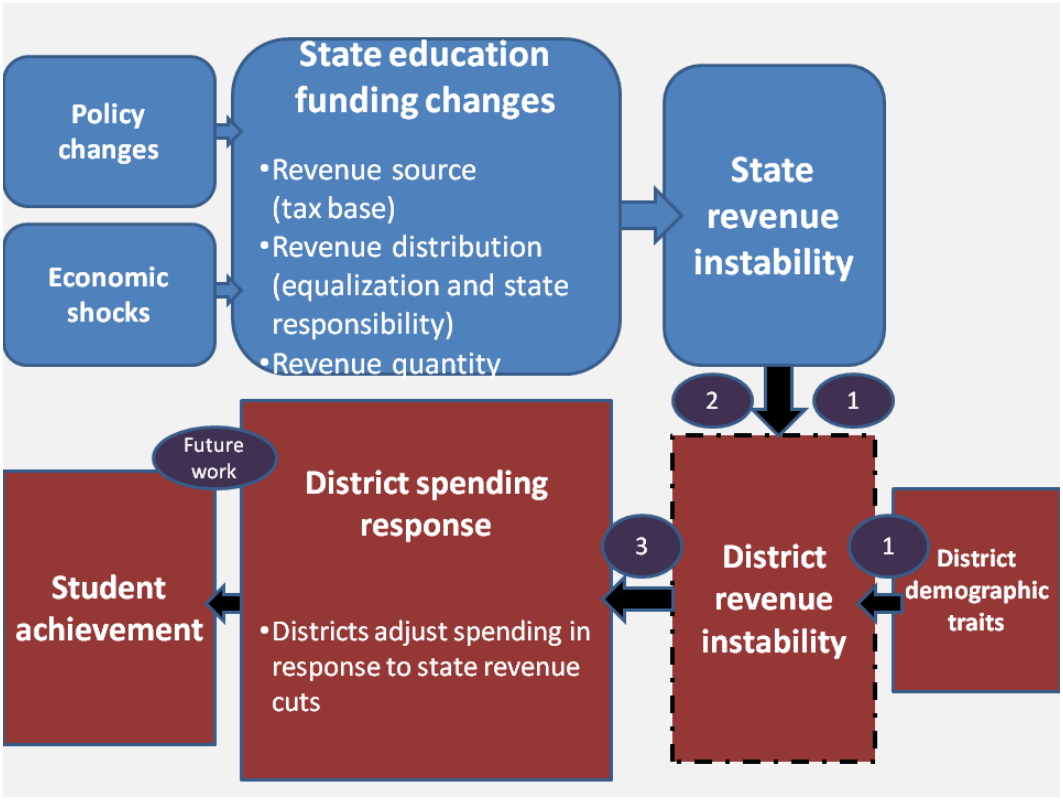
I seek to advance the research on school finance in several ways. Drawing from techniques both within and outside of public finance, I contribute a new measure of fiscal stress based on unpredictability of state revenues. Second, I explicitly assess the mechanisms that may aggravate revenue instability for school districts and to what extent instability changes over time. Finally, I examine how school districts respond to chronic unpredictability in state revenues.

**Analysis**

This dissertation presents the foundational research necessary to investigate the link between resources and achievement. It sits at the intersection of economics, public management and educational administration. Tax economists and public administration scholars often review fluctuations in state revenues and volatility in the tax base. Economists of education often study change in school district spending per-pupil. But no one has brought these two ideas together, to assess how state revenue instability is passed on to districts over time, and how that instability may influence changes in spending per-pupil. In Figure 1, I depict a causal cascade, or chain of events that relate state-level phenomena (rounded boxes) to district-level outcomes (rectangular boxes). Each chapter in my dissertation addresses a key step in this cascade. Below I briefly describe each essay; the essay numbers correspond to the respective numbers in the diagram.

1) Essay 1 presents various measures of revenue unpredictability, a critical first step given the absence of a consensus or reliable measure of over-time unpredictability. I build on a naïve model of the district budget officer's forecast of expected revenue changes, with more accuracy than the budget officer alone might achieve. Though some prior research has addressed isolated episodes of revenue declines or shocks, I distinguish between shocks and unpredictability and assess *long-term* patterns of instability in different revenues sources *within* districts. I examine state and district characteristics that explain variation in revenue instability. I use my preferred instability measure in the subsequent essays as outcomes and predictors of interest.

**Figure I1. A Causal Cascade Transfers State Revenue Instability to the School District.**



2) Essay 2 estimates the causal effect on revenue instability of a policy change that altered both the role of the state and the mix of resources in K-12 funding (an example of the rounded box titled “State education funding changes.”) In 17 states, school finance equalization involved both an increase in state responsibility for school funding and a shift toward more volatile income and sales tax revenues. I assess whether this joint change increased instability in state aid to districts by exposing districts to a more volatile tax base, or whether instability decreased over the long-run as state funding insulated districts from bearing the sole burden of economic fluctuations.

3) Essay 3 takes the next step and examines how spending responds to revenue instability. I describe district spending changes in California, a state with chronic unpredictability in state finances over the past decade. I examine specific cost-cutting and saving mechanisms districts use, drawing on primary survey data, which provides more detail than that available through administrative data alone.

Throughout these essays, I focus on several mechanisms suggested by theory and prior empirical literature that may moderate or explain the magnitude of revenue instability, and its relationship to spending. First, I examine revenue mechanisms that may underlie instability patterns. District reliance on state revenues, or the level of state responsibility for school funding, is a key factor in all three of the essays. State responsibility may explain variation in revenue unpredictability; is an underlying mechanism in school finance reform; may moderate the relationship between revenue and

spending volatility; and is above the national average in California, making it an appropriate state to examine. The other revenue mechanism I assess is the education tax base. I test whether districts in states that rely more on state sales and income taxes, which are known to fluctuate with the business cycle, have more unpredictability in state revenues than states that rely more on local taxes to fund education.

The second set of mechanisms I examine relate to district composition. First is district size, as measured by student enrollment and by number of schools. Smaller districts may have less diversity in their revenue sources, potentially increasing their exposure to state funds and attendant unpredictability. In addition, a five percent cut in operational spending likely will be more concentrated in a district with one high school than a district with 20 high schools. The second demographic factor I examine is student poverty. I assess whether high-poverty districts experience more or less revenue instability, and if their instructional spending is more or less responsive to the unpredictability in revenues. One might be concerned if districts serving poor students were more likely to face unstable revenues. Similarly, if high-poverty districts are pursuing more severe budget cuts in response to unpredictability, they may further limit their ability to serve the instructional needs of all students.

Finally, I examine institutional mechanisms that may limit or aid districts in coping with fiscal stress. In the case study of California, I address whether use of reserve funds and the ability to generate additional local revenue sources are related to budget cuts and other spending responses to state-revenue instability.

**Findings**

I find that school districts do, indeed, face unpredictability in state revenues. Regardless of the measure used, district face uncertain state revenues from year to year, and that uncertainty varies by district characteristics, such as enrollment. Unpredictability in revenues is, not surprisingly, greater during and immediately after economic downturns, more so for some districts than others. In short, high revenue unpredictability is not a one-off phenomenon or something that occurs for only a handful of districts, but rather a recurring issue with which many districts must cope. I briefly summarize the findings from each paper:

1) *Measurement of unpredictability*: I go beyond the magnitude of change and total fluctuation that prior literature discusses and isolate the unpredictable component of state revenue change, which districts have fewer institutional mechanisms to address. I construct a measure that represents the unpredictable component of the change in state revenues predicted by two prior years' changes. Reviewing the three mechanisms of interest, I find that districts with high reliance on state revenues and that are larger have *less* revenue instability. As state responsibility for funding has increased over the past three decades, revenue instability has decreased over that same time. The most notable finding is that districts serving mostly poor students are *less* revenue-unstable, suggesting they may benefit from revenue structures that buffer them from instability.

2) *Effect of reforms on unpredictability*: When I evaluate changes in average unpredictability in 17 states that increased state contribution of funds through

finance equalization reforms and shifted the tax base toward more cyclical sales and income taxes, unpredictability is the same or lower five years after finance reforms were implemented compared to five years before the reform was implemented. This finding suggests that average instability does change over time within districts. It also points to the idea that state responsibility for funding may have buffered districts against the fluctuations of the income and sales tax-base, effectively neutralizing the ill effects of tax volatility.

3) *District responses to state budget changes in California:* In a sign of the changing fiscal climate, more district officers perceive the problem of state budget cuts to be worse in 2010-2011 than in 2005-2006 and place high importance on predictable state funding. Sampled districts cited cost-cutting measures more than revenue-raising measures as responses to state budget cuts. High-minority, high-poverty districts are more likely to pursue severe district-level budget cuts (cuts of 6 percent or greater). Experienced chief budget officers are more likely to pursue cuts to teaching staff. But few districts surveyed considered shared services or other efficiency-oriented measures. Notably, districts exposed to greater instability in state revenues appeared to adjust or even adapt spending accordingly.

In sum, unpredictability in state revenues is a phenomenon that concerns school districts, one that changes over time, but one to which they may adapt.

**Contribution & Policy Implications**

My findings suggest important implications for the fields of public economics and economics of education. First, rather than focusing just on revenue levels or changes in levels to understand cross-sectional inequality, I attend to within-district, over-time instability. My analysis goes beyond prior analysis of revenue shocks and provides a reliable measure and evidence on the role of unpredictability in state aid. As many states incorporate more fiscal measures into accountability and monitoring report cards, they may need to go beyond just reporting per-pupil spending levels and also include some assessment of revenue and spending stability. States could account for exposure to unpredictability in state aid when ranking district performance in other areas. Just as one might compare and rank districts with similar demographics against each other, report cards could compare districts exposed to similar degrees of unpredictability in a given year to each other.

Despite a rich literature assessing the effects of tax and spending limitations on school district spending levels, that literature overlooks some key factors. Unstable revenues may constrain districts as much as or more than explicit tax or spending limits have been shown to do (Figlio, 1997; Downes & Figlio; Mullins 2001, 2004). Policies to limit tax rates and unpredictable declines in revenues are, in effect, known and unknown constraints, both of which bind. My analysis provides a more complete test of the binding constraints that could change fiscal choices.

While there is emerging work on tax volatility and how it affects states, such work typically does not address how this plays out for different public sectors (education versus health) or how it affects local government units. Much of the public finance

literature has focused on states or counties, and disregarded school districts as a unit of analysis for responses to fiscal stress. This may be because the school district does not align neatly with existing models of government behavior.

Scholars in a variety of disciplines need a theory appropriate for intermediate governments such as school districts. First, consider that as states have moved closer to full state funding of education, districts face limits on local revenue-raising and rely largely on revenues allocated by the state; meanwhile, district spending needs to satisfy the preferences of local voters. Neither firm nor consumer models of choice in economics effectively model this dilemma. Second, in the current era of state centralization of revenues and externally-imposed accountability regimes, the school district is neither its own revenue-maximizing Leviathan government (Brennan & Buchanan, 1980) nor does it face binding voter preference constraints according to a median-voter model. Further theoretical work is necessary to identify a model that is appropriate for an intermediary government that must make spending choices in a setting that is constrained by higher levels of government.

**Future Research Agenda**

My dissertation findings offer a rich scope of future work. As indicated earlier, the logical next step for this study is to test the link between revenue instability, spending and student achievement outcomes. A second line of inquiry concerns whether highly constrained districts can actually smooth spending in response to revenue instability. A final research area concerns the relationship between politics and revenue unpredictability. First, one might be concerned that states with high party turnover in the executive or legislative branches may experience shifts in program priorities that

exacerbate revenue unpredictability. Second, unpredictable revenues may influence the incidence of local education reforms. For instance, districts may be less likely to introduce ambitious education reforms in the years following higher unpredictability. In sum, there is ample opportunity for extension of the dissertation to areas of interest to the political science, public administration and economics of education fields.

# Essay 1

# Measurement of Revenue Instability

## I. Introduction

Since the economic downturn in 2008, nearly 33 states have cut funding to school districts. State tax revenues—which make up nearly half of all public school revenues—fell by 8.4 percent in 2009 and an additional 3.1 percent in 2010. States collected less in sales and income tax revenue than they had projected for fiscal year 2010.[1] States have not only cut K-12 education funding across the board, but in recent years they have adopted budgets well after the start of the new fiscal year—and even still have made additional funding cuts to education *after* enacting the state budget.[2] School districts have responded to such uncertainty and shocks with sober cuts: teacher layoffs, four-day school weeks, fewer classes, and salary freezes.[3] The cycle of state revenue shortfalls and district budget cuts highlights two important phenomena: the degree to which districts rely on state revenues to fund their ongoing operations, and the dependence of state education funding on tax revenues that oscillate with the business cycle.

While state revenue instability clearly affects public school districts, the degree or consequences of this instability have received little academic attention. Much of the school finance literature has focused on the distribution of resources across schools or school districts, while implicitly neglecting the source of those revenues and their stability. If the tax base for education is unstable or unpredictable, then revenues for school districts will be unstable as well. The presence or degree of instability matters if such unpredictability imposes a fiscal constraint.

[1] National Association of State Budget Officers, *Fiscal Survey of the States*, 2010 and 2009.
[2] National Conference of State Legislatures, 2010 Budget report. For example, Governors in Kansas, Kentucky, Michigan, Mississippi and New York proposed cuts to the FY2010 education budget post-enactment.
[3] Author's own 2010 survey; series of articles in Education Week's 2011 *Quality Counts* report.

From the perspective of policy and practice, unpredictability may be more salient to districts than the magnitude of overall change. Increasingly, districts have limited options for raising revenues that supplement their state allocation. Thus, unpredictable allocations may prompt districts to truncate policy reform and implementation before it can come to fruition, exacerbating so-called "policy churn," (Hess, 1999; Stone, Henig, Jones, & Pierannunzi, 2001; Marschall and Shah, 2005). Uncertainty about future revenues may make it difficult for districts to retain teachers, fulfill instructional plans, or even make ordinary purchases. In effect, unpredictable changes in revenues may be associated with some potential inefficiencies or losses. By contrast, known or expected changes to revenues may constitute volatility, but may not produce the unpredictable, inefficient changes in revenues to which districts have limited institutional mechanisms to respond.

This paper focuses on the extent to which school districts face revenue instability and how this instability has changed over time. Because the research literature on revenue instability for school districts is sparse, the primary task of this paper is to construct a meaningful measure of instability. I define instability as the component of variability in revenue fluctuations that is not predictable. In particular, this paper asks the following research questions:

1) What are the merits of different approaches to measuring revenue unpredictability? To what extent do measures vary in their portrayal of the magnitude and timing of instability?
2) To what extent does revenue instability vary over time?

3) How much does revenue instability vary across and within states, and how much of this variability is explained by the demographics and enrollment of the district?

This study fills several gaps in the literature. First, I examine instability within a district over time, rather than inequity or dispersion across districts, which has been the focus of most prior research on school funding (see for examples, Odden & Picus, 2003; Murray et al. 1998).

Second, while I am not the first to study tax revenue instability (for examples of tax base variability, see Poterba, 1994; Sobel & Holcombe,1996; Russell & Randall, 1996), I am the first that I know of to examine revenue instability for school districts. In addition, I study this instability both over an extended time period and focus on the district level instead of the state level. The district is a vital unit of analysis for understanding causes and consequences of instability. Districts mediate state policy—for example, through instructional programs to fulfill state standards—and steward the bulk of state education revenues. In addition, many districts face practical or policy limitations on raising local revenues (Downes & Figlio, 1999), so their budget constraint is often a direct function of state revenue conditions. Thus, a shock to state revenues likely shocks a district's per-pupil revenues as well, such that instability reverberates. One can infer that state revenue instability matters for districts, but the literature does not address this link. Tax stability studies do not address the impact of tax variability on the education sector, and school finance literature tends not to examine revenue stability within a given district over time.

The third gap I fill is a methodological gap. Panel data, which tracks a unit over time, provides more opportunity to identify within-group changes. Yet education policy research using panel data tends to focus more on between-unit differences than within-unit changes over time. Given the inertia in any governmental institution, particularly school districts, there is likely serial correlation between observations over time; decisions made last year steer results this year (McCleary, Hay, Meidinger, McDowall, & Land, 1980). That relationship merits further attention when modeling public budgeting in general and school finance in particular. Yet school finance researchers have not explicitly modeled the time-series nature of district revenues and spending. In fact, they have rarely used true annual panel data with which to assess such responses, relying more on census-based data that is published at less frequent intervals. To this end, I construct a metric of revenue instability that accounts for autocorrelation and removes time trends in order to isolate the unpredictable component of revenue fluctuation.

The rest of the paper is organized as follows. In Part II, I discuss how I measure instability, compare different measures, and describe my data and summary statistics. In Part III, I examine how revenue instability has evolved over time, and relate district characteristics to revenue instability using select fixed effects models. In Part IV, I conclude with some directions and implications for future research.

## II. Data & Methods to Measure Instability

This analysis requires data across states and across districts within states. It also requires sufficient years of data to measure instability and to examine trends over time. I assemble several administrative datasets from the U.S. Department of Education's National Center for Education Statistics (NCES)[4] to create a panel of independent and dependent districts spanning at least 25 years. The panel improves upon earlier school finance papers, which rely on the Census of Governments. Such data, from years ending in 0, 2 and 7, are not suited to assessing year-to-year shocks or instability trends over time.

I start with the Common Core of Data, an archive of the annual surveys and administrative reports that states collect from local education agencies and submit to NCES. The Common Core (CCD) is the most comprehensive single source of annual district-level budget data with revenue and spending categories identified separately. In addition, the standardized reporting form allows for comparisons across districts. I begin with the CCD's Longitudinal School District Fiscal-Nonfiscal Detail File spanning FY1990-2002, with a record for each school district. The dataset does not contain more granular data on revenue sources, so I merge in local and state revenue-source variables from the individual annual Local Education Agency Finance Survey (F-33) Data for FY1990-2002 available from the CCD. To this dataset, I increase the number of earlier years by adding revenue and operating expenditure variables from FY1970-1990 using the Historical Database on Individual Government Finances (IndFin). Finally, I increase the number of post-2002 years by merging annual data from FY2003 to the present. To

[4] Fiscal Data: Historical Database on Individual Government Finances (IndFin), 1970-1989, available upon request; Local Education Agency Finance survey (F-33), 1990-2008 available at http://nces.ed.gov/ccd/f33agency.asp. I check for continuity in reported revenues over time and adjust for inflation using the CPI-U. Demographic data: Public Agency Universe survey FY1987-2008, available at http://nces.ed.gov/ccd/pubagency.asp.

this dataset of finance variables, I add student demographic information in order to assess the relationship between instability, spending and district characteristics. I use district-level student demographic information drawn from the Public Agency Universe datasets. Appendix Table A1 details which dataset provides which variables.

The data consist of K-12 unified districts and pseudo-unified districts (elementary and high school districts combined in the data to allow for comparisons with unified districts). I exclude certain kinds of districts from analysis: i) charter districts, since such districts were not present at the beginning of the study period, ii) vocational and special education districts, since they are receiving special types of funding and enrollment conditions, and iii) districts with fewer than 200 students on average since 1980, since some of these districts subsequently consolidated with larger districts, making long-term revenue instability patterns difficult to identify. Prior studies of school finance (Murray et al. 1998) using a similar dataset exclude some states, and I follow suit: removing Montana and Vermont because they have almost no unified districts, Delaware and Nevada because they have so few districts, Hawaii because it is a state-based system and District of Columbia because it is the only district in the jurisdiction, therefore providing no variation in state revenue instability. All told, I have a district panel with demographic and fiscal characteristics consisting of 10,208 districts. For analysis I use data from 1980 onward since more districts have complete fiscal data from then onward.

[ Table 1.1a here ]

Table 1.1a reports cross-sectional time-series summary statistics of fiscal data for 10,208 districts over approximately 28 years. I restrict to that sample for analysis.[5] N represents district-year observations, and n represents the number of districts in the panel with that variable. T represents the average number of years of data available for the variable. If one were to subtract the mean for each variable from the observation in each year for each district, the variable would be time-demeaned within a district. The 'within' statistic summarizes the standard deviation for the time-demeaned values across districts. Despite some extreme minimum and maximum values, the standard deviation for each revenue and expenditure variable is quite small. There is variability within districts over time, but the standard deviation within districts is smaller for most revenue and expenditure variables than the standard deviation between districts is.

Across districts in the sample, average per-pupil total revenues and total expenditures (in per-pupil, inflation-adjusted 2008 dollars[6]) are similar at $9,497 and $9,512 per pupil, respectively. State revenues have a mean value of $4,485 per pupil, suggesting they make up just under half of total revenues. Federal revenues have a mean value of just $476 per-pupil, but with a high standard deviation of $791. Local revenues have a mean value of $3,175, with a high standard deviation of $3,985. As expected,

[5]The local revenue variables tend to be less complete for some districts, so the sample size for local revenue variables is about 500 districts fewer. The instructional salaries variable begins in the dataset starting in 1990, so while the number of districts is comparable to the other variables, the number of years is lower at 18 instead of 28 years.

[6] One might be concerned about the comparability of revenues over time. For instance, the purchasing power of state revenues has changed over the time frame for my study. To this end, I adjust these data into real 2008 dollars, using the Consumer Price Index for Urban consumers. Following convention, I also transform the revenue variables into a natural log scale for analysis. The distribution of revenue variables is right-skewed, and the natural logarithm normalizes the distribution. This transformation permits the use of Ordinary Least Squares estimation when these variables are the outcome.

To compare across districts, I construct per-pupil revenue variables by dividing revenues by enrollment for each district. Average Daily Attendance (ADA) statistics are not available in the datasets I use, so the per-pupil numbers in my data may differ from what districts may report in their own budgets based on ADA.

most local revenue is local property tax revenues, with a mean of $3,207 per pupil. However, the standard deviation between districts is $2,607, reflecting that some districts are generating far more in local property tax revenues than others. On the expenditure side, operating expenditures have a mean value of $8,153 per pupil with an overall standard deviation of $3,860. This category includes spending on instruction and support or administrative services. Instructional expenditures have a mean value of $5,626, with a high standard deviation of $23,444, variation that is largely within district. This suggests that between 1990-2008, when data on instructional spending are available, within-district spending in this area has fluctuated greatly. Spending on support and administrative services has a mean value of $3,146 per pupil, with a high standard deviation of $11,351, most of it within districts.

Part of this paper's goal is to describe differences in revenue instability across districts with different characteristics. Table 1.1b presents summary statistics for variables that I hypothesize are associated with economic vulnerability and possible mobility of students, and that may affect changes in per-pupil revenues from year to year. I present the variables in continuous and binary form (an indicator variable for the top or bottom quartile of districts for each variable). The variables in Table1. 1b are included as district-level predictors of instability in analysis in Section IV.

Although reliance on state revenues is a fiscal variable in principle, for this paper I treat it as a district characteristic that may explain variation in revenue instability. To represent reliance on state revenues, I include the proportion of the district's total revenues contributed by state revenues. As Table 1.1a suggested, the average contribution of state revenues is 49 percent. The standard deviation within districts is half of the

between-district standard deviation, suggesting that district reliance on state revenues varies somewhat over time. The minimum and maximum between districts reveal that some districts receive just 3.6 percent of their revenues from state revenues while some districts are 87 percent funded by the state and a few outliers in some years are 100 percent funded by the state. I create an indicator variable for high state revenue share for districts receiving more than 60 percent of their revenues from state revenues—this threshold point corresponds roughly to the top quartile of state revenue share values, so close to one-fourth of the districts, 26 percent, are "high state share" districts.

To capture district size, I include district enrollment. Average enrollment in the sample is 4,015 students, with a large standard deviation of 14,029 students. The median enrollment (not shown) is 1,623, suggesting that the sample consists primarily of small to medium-sized districts. The variability in enrollment is mostly between districts, as expected. The sample includes districts such as New York City with nearly 1 million students, as well as districts that in some years dropped down to just 94 students. Student population increases in some states (e.g. in the Western U.S.), while some urban districts have experienced declining enrollment since the mid-1990s. Because the variable is not normally distributed, I transform enrollment using a natural logarithm. Log enrollment is closer to a normal distribution and has a sample average of 7.45.

I use the proportion of students eligible for the federal Free- and Reduced-Price Lunch program as a proxy for poverty and a measure of income in the district. On average in the sample, nearly 26 percent of students are eligible for the federal program. Again, such students are not evenly distributed across districts, with some districts reporting as much as 96 percent of their students eligible. The between-district standard

deviation is double that of the within-district standard deviation at .168. This variable is available beginning in the 1986-1987 school year, so it exists in the dataset for just 20.6 years rather than 28 years.

Table 1.1b also includes student-teacher ratio. The variable controls for the district's operating expenditure obligations. The average ratio in the sample is 15 students to one teacher, though it is as high as 39 in some districts, and there is one district in one year that had a ratio of 67. This variable appears in the dataset for 19.8 years, rather than 28 years.

Finally, I create indicator variables for districts in the top quartile of state revenue share, poverty and student-teacher ratio, to allow for a non-parametric relationship between these variables and revenue instability. By definition, these are all roughly 25 percent. I also include an indicator for small districts, to control for the different revenue and spending burdens facing districts that lack economies of scale. I define 'small' as those districts below the bottom quartile in fiscal year 2008, the last year of data available. About 18 percent of districts are small by this definition.

[Table 1.1b here]

### *A. Measuring Instability*

Despite a nascent literature discussing variability in local government revenues (Chapman 2003; Alm et al, 2009; Gore 2008), there is not a widely accepted single measure of revenue instability. In addition, rigorous comparison of measures of instability in local government finance is largely absent. This raises the question of what is a 'good' or appropriate measure of instability. This section assesses which measures capture the unpredictable component of instability, and to what extent those measures vary in their portrayal of the magnitude and timing of instability.

*Criteria:* In studies of inequality, some authors have compared inequality measures against chosen criteria (e.g., Murray et al.; Odden & Picus). I take a similar approach here, first outlining possible measures and then reviewing possible model specifications to obtain those measures. I use the following criteria to evaluate the appropriateness of each instability measure for my study. The optimal measure would meet all of these criteria:

1) Does the measure capture the *unpredictable* component of revenue fluctuations?
    - One would not want to call consistent or intentional increases in revenues as instability. The researcher's task is to purge those changes that could be foreseen and isolate the changes in revenues that were unpredictable. Inherent in isolating the unpredictability is minimizing bias and maximizing precision.

2) Does the measure itself vary over time?
    - While a time-invariant or summative measure may be useful for ranking districts, it may sacrifice information about how instability moves over time. In addition, a time-invariant measure limits the type of models that can be run. One needs a time-varying measure to plot changes over time graphically and to use time-varying covariates as predictors in a model.
3) Does the measure allow for comparisons across districts?
    - Policymakers may be interested in an instability measure that allows them to assess the magnitude of instability each district experiences and potentially target their attention to those districts that are most unstable. Researchers may want to assess whether the most revenue-unstable districts are those associated with characteristics of demographic vulnerability, such as poverty.

*Measures:* Based on a review of prior literature in school finance as well as statistical measures of dispersion used in other fields, I identify model-based and calculated measures of variability. Table 1.2a summarizes these measures and the formulas. Among model-based measures, an obvious first candidate is the residual from a well-specified model. The residual should quantify the unexplained uncertainty, or the unpredictable component of change in the outcome. A second candidate is the standard deviation of the predicted residual ($\sigma_{\hat{u}}$). This measure is useful to identify the magnitude of the variability the district faces and which districts have particularly large errors. The

$\sigma_{\hat{u}}$, also called the Root Mean Squared Error (RMSE), is often used to measure forecast error in time series. The RMSE is the square root of the average squared difference between forecast and corresponding observed values. Higher values indicate more instability. As I will discuss later in this section, I use the past to predict the present (an observation in the sample), rather than to forecast the future (an out-of-sample value).

I also review data-based measures that I (and possibly a district budget officer) could calculate without a model. First, I consider the intuitive measure of the year-to-year percent change. This time-varying measure would capture the change in the current year compared to the prior year. The other candidates are more summative measures. The mean absolute deviation examines the absolute difference in revenues in a particular period from its over-time mean, in particular whether it is more than one standard deviation away from the historical mean. The coefficient of variation, or the standard deviation divided by the mean, is a standardized measure of variability typically used to measure dispersion across districts or states in per-pupil spending.[7] It typically is a cross-sectional measure and does not involve the dimension of time. To measure instability, I would have to take the observations for each district over time, and calculate the standard deviation and the mean for that district.

In Table 1.2b, I compare the measures from Table 1.2a against the criteria outlined at the beginning of this section. First, I discuss model-based measures (I review the models used to create these measures in the next section). The residual fulfills all three criteria. The residual from a well-specified model should capture the prediction error, and therefore meets the first criterion that it captures the unpredictable component

[7] For example, see Murray et al. (1998), who use the measure to examine within-state changes in the distribution of inequality after court-ordered school finance reform. Odden & Picus (2004) also use it to examine distribution of per-pupil expenditures within a year. Chapman (2003) compares the average CV for each revenue source between two time points across 57 counties in California.

of revenue fluctuations. If the model to obtain the residual uses revenues for each year as the outcome, then the residual will also vary by time, thus meeting the second criterion. Finally, because I will run the same model for every district, the residual will be in units that allow for comparisons across districts.

The standard deviation of the residual (or root mean squared error from a model) will capture the magnitude of the unpredictable component, meeting the first criterion. But it is a summary measure, and therefore does not vary by time, which does not meet the second criterion. The measure is expressed in units that are comparable across districts, meeting the third criterion. Although it cannot serve as the sole outcome, the standard deviation of the residual could serve to rank or summarize instability across districts.

In terms of data-based measures, none of these meet even two of the criteria. The annual percent change in revenues is an intuitive and easy-to-explain measure. But it does not have a way to isolate just the unpredictable component of revenue instability, so it does not meet the first criterion. It does vary by time, meeting the second criterion. But it fails to meet the third criterion. The baseline revenues in a given year are not the same across districts. Therefore, the percent change would provide a distorted comparison of the magnitude of the fluctuations across districts, especially for districts with large changes.

The mean absolute deviation could isolate the unpredictable component by measuring how far from the historical mean a district's revenues are in a given year. But each of these deviations is summarized in an average, which means the measure itself does not vary by time and therefore fails the second criterion. In addition, it is not clear

whether the average absolute deviation is scaled in such a way that it could be compared across districts.

The coefficient of variation is a summative measure of overall variability, so it cannot isolate the unpredictable component of fluctuations, failing the first criterion. In addition, it does not vary by time, failing the second criterion. Because the measure is standardized, it does allow for comparison across districts, which meets the third criterion.

*Model Specification:* The next question is what model specification should be used to obtain the residual. The overall goal is to obtain an estimate of the unpredictable component of change in revenues from year to year. I have already discussed the intuition that revenues in one year are likely related to revenues in the subsequent year for a district. A time-series regression, in which I regress current values of a variable against its lagged values, can model this relationship across years. If there is an underlying trend in the data, I need to determine what kind of trend and then de-trend the data to the extent possible. In addition, the preferred model should provide unbiased and efficient estimates of any forecast of change in order to yield a residual that correctly identifies that change that could not be forecast. Both of these concerns rest on the assumption that the time series for the state revenue variable is stationary. Stationarity is defined as the probability distribution in year *t* being the same as the distribution in year *t-1* (or that a series tends to return to a constant mean). This is a strong assumption, to be sure. I review several models below against these criteria. Table 1.2c summarizes the different specifications I examine.

I discuss building the model in terms of the predictors or lags I could use, the form of the predictors, and the sample for estimation. First, I need to determine the predictors in the model. To this end, I want to know whether districts use information regarding past revenues or demographics to predict or assess expected current revenues. My goal is to build on information a district might use, and then isolate the component of variability that is least predictable and quantify that. Although we cannot know what information *each* district uses to predict or estimate future revenues, evidence from public budgeting literature and evidence from a recent survey[8] in California suggest that districts likely examine recent revenues to assess expected current or future revenues. When I piloted a survey of district budget officers, I asked districts how large a problem unpredictable state revenues were and what information they used to predict revenues for the upcoming fiscal year. Essay 3 reports results from this survey.

In addition, many districts are required to report at least three years of past revenue and spending data when they submit their proposed budget for the subsequent fiscal year. As districts estimate what they can afford to spend in the coming year, they may examine revenue patterns for the past two to five years and look for correlations between revenues and time to see the extent to which state revenues in particular are increasing or decreasing. I can approximate this process by using past and current revenues to predict the upcoming year's revenues. Once I include past revenues to predict the future, I have a lagged dependent variables model that may isolate more of the unknown variability in the residual. Table 1.2c presents several types of lagged models, which typically appear in macroeconomics or other time-series assessments where researchers are concerned about serial correlation (Stock and Watson, 2007).

[8] Author survey in 2010. A small portion of districts report changes in enrollment as a key factor as well.

To this end, the second specification issue concerns serial correlation[9]: Are prior revenue *levels* or *changes* more prone to autocorrelation? First, I compare a lagged dependent variable model with change to a lagged model with levels. The Dickey-Fuller test (Dickey and Fuller, 1979) reports whether a unit root exists in the autoregressive model. The null hypothesis is that the variable contains a unit root, or is not stationary across time points. Thus, I want to see small p-values for this test. Only for a lagged model of year-to-year differences in state revenues do I observe small p-values for my sample of districts ($p<.05$). I cannot reject the null that the lagged model of state revenue levels is not stationary ($p=.63$). It is not surprising that the test points to a model based on changes. Taking the first-difference of a variable typically removes the non-stationarity, and relating current to prior growth implicitly de-trends the data.

Second, I test the number of lags necessary to remove autocorrelation. I use Durbin's alternative statistic, which provides a test statistic for serial correlation relative to the number of lags used. For this test, the null hypothesis is that there is no serial correlation. I obtain small p-values for this test when I run the model with just one lag, meaning that there is serial correlation between state revenues in year *t* and year *t-1*. However, when I use two lags, or two periods of changes to forecast an upcoming change in revenues, the test indicates that I no longer have serial correlation in the model. In short, including two lags of changes yields a model that is stationary, which means I have removed the underlying trend and that the joint probability distribution does not change relative to time.

[9] Recall the definition of autocorrelation is $cov(Y_{t,}Y_{t-1}) \Big/ \sqrt{var(\,Y_t)var(\,Y_{t-1}\,)}$

Now that I have confirmed a lagged growth model is preferred, the third specification concern is whether to fit it for the pooled sample of districts, or fit the model individually for each district to isolate the variability unique to that individual district. The bottom portion of Table 1.2c compares these options. Each district likely examines just its own past revenues and expenditures, rather than looking at all districts, for reasons of both relevance and data access. The variability that each district faces is an interaction of state revenue patterns and its own demographics that determine revenues received. As a result, there is little theoretical motivation to pull in information from other districts that may bias the variability for district *d.* I test this idea empirically. I examine the fitted residual obtained from a linear regression of the pooled sample with multiple lags using Newey-West standard errors to allow for heteroskedasticity in errors between districts and autocorrelation in errors *within* districts.[10] The residual from the pooled model is correlated with the residual from the model fitted individually for each district with robust standard errors at greater than 0.99. Thus, I can choose the model that best isolates the unknown or unpredictable component for each district.

Because the differences model de-trends the data and two lags are sufficient to remove serial correlation for nearly 95 percent of the sample districts, I use the lagged growth specification from Table 1.2c:

(1) $\Delta ln(Revenues)_{dt-(t-1)} = \alpha_d + \beta_{1d}\Delta ln(Revenues)_{(t-1)-(t-2)} + \beta_{2d}\Delta ln(Revenues)_{(t-2)-(t-3)+} u_{dt}$

The residual ($\widehat{u_{dt}}$) in such a model captures the part of revenues that is *unpredictable* based on prior revenue streams and trends throughout the district. McCleary et al. (1980)

[10] The Newey-West model requires that I specify the same number of lags for all districts, while the individual model allows me to include the number of lags suggested by Durbin's alternative test for each district.

and Stock and Watson (2007) argue that unless one has empirical or theoretical motivation for modeling it deterministically, the preferred specification of a time series is a model with a stochastic trend (one that is random and varies over time). As part of a stochastic model, these authors suggest that a model of a stochastic trend should allow for so-called drift (the alpha term in equation 1), so that the forecast adjusts for any tendency in the time series to move up or down over time. Per-pupil revenues have, indeed, been increasing since 1970, even in inflation-adjusted terms. But the increase does not mean there has been a linear or otherwise deterministic rate of increase in revenues occurring for each district in each year. These authors argue that it is difficult to impose a deterministic model over a time-span in which many factors are changing simultaneously. A fixed effect would account for the deterministic, but unobserved, behavior of the district.

Thus, the review of model specification options suggests that I need to obtain the residual from a model fitted for each district individually, since a district fixed effect in a pooled sample would impose a deterministic trend. In addition, statistical tests for autocorrelation confirm that a model of two lagged changes is more stationary than a model of levels or one that simply includes a time trend without lags.

*Specification checks:* To address concerns about whether different specifications assess the magnitude of instability differently, I compare the root mean squared error from the different specifications outlined in Table 1.2c. First, I obtain the RMSE from a lagged dependent variables model of *growth* with two lags (as in equation 1).[11] Second, I

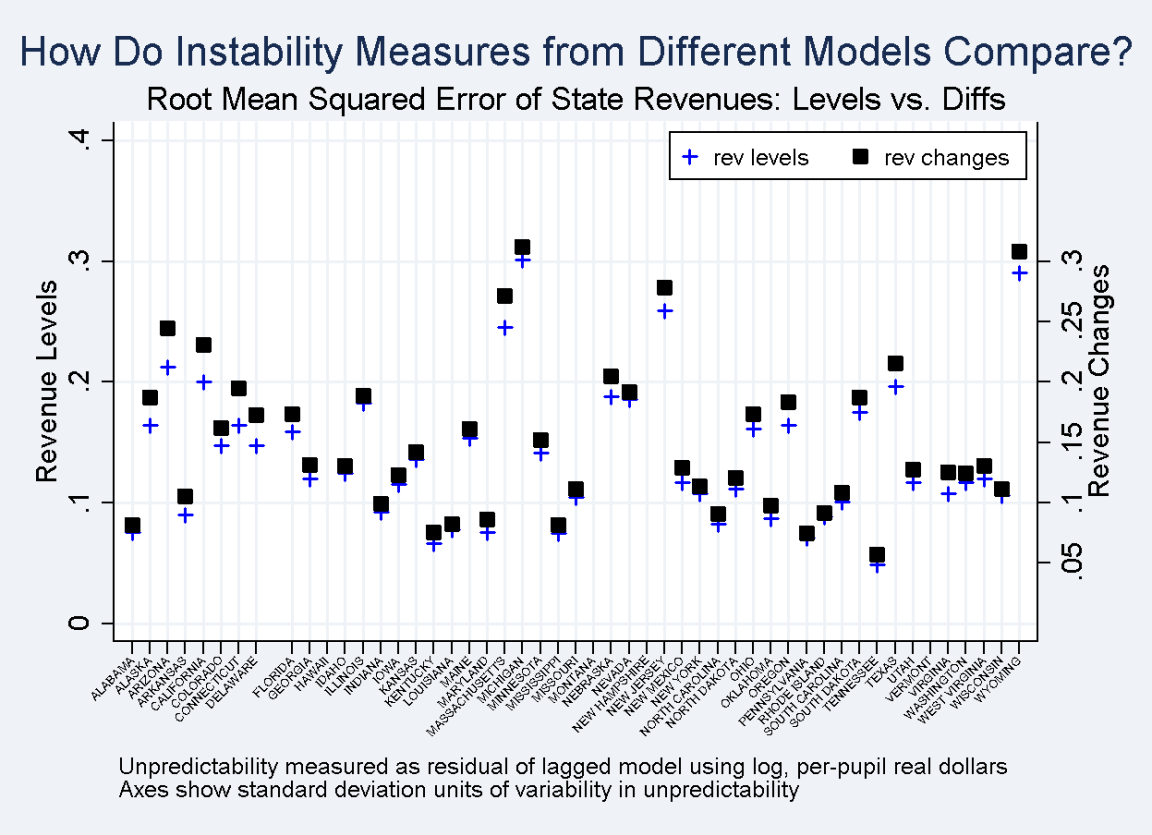
[11] Edgerton et al. (2004) suggest that the RMSE, or standard error of residuals, from a regression of annual growth on a lagged growth rate reflects changes from the forecast.

obtain the RMSE with *levels* as the outcome and two lags. Finally, I run a naive model with levels as the outcome and simply de-trend the model without any lags as predictors. The correlations are shown in Table 1.3. The correlation between instability measures from the lagged models of growth and levels is highest at 0.983. The correlation between a lagged growth model and one that simply de-trends growth is 0.929, suggesting that the lagged model does de-trend. Although the de-trended model of growth and levels is correlated at 0.826, it does not suggest that those models have addressed concerns about serial correlation nor does it necessarily capture what a district budget officer might use to forecast revenue changes. Thus, I use the growth model for the rest of the paper because it removes serial correlation.

[Table 1.3 here]

I visually display the correlation between the instability measure from the lagged model of levels versus differences in Figure 1.1. I average the Root Mean Square Error across districts within a state  This allows me to see how the measures compare within states and then vary between states (state are presented alphabetically).  As the high correlation indicated, there is little difference between the measures.  The estimated RMSE from the model of differences is either the same or slightly higher for state revenues for most states. Thus, I choose the RMSE from the lagged model of change as a summative outcome measure.

**Figure 1.1. Instability measure from lagged models of levels as the outcome are same or lower than in models with differences across states.**




To present summary statistics of instability for different revenue and expenditure categories, I use a summative measure, similar to what is displayed in Figure 1.1. This is the standard deviation of the residual (the root mean squared error) obtained from the lagged model of differences fitted for each district. This measure captures the variation in unpredictability that each district experiences from 1980-2008. The number of years used influences its size – a shorter or longer time period will yield a different standard deviation of the residual. The measure is in standard deviation units of the error of a logged variable. If I standardize the residual as in a z-score, it would be similar to this measure. I show these summary statistics in Table 1.4a.

Variability in instability of total revenues summarized across the years is lower than other revenue sources at 0.105 standard deviation units. The mean instability in federal revenues is larger than any other fiscal variable at 0.357 standard deviation units, confirming prior research that intergovernmental grants are more volatile. State revenues are the next most unstable, at 0.163 standard deviation units, half of the instability in federal revenues. Notably, instability in local property tax revenues is not trivial: it is 0.149 standard deviation units. But this variation likely affects a smaller portion of a district's budget than state revenues do.

[ Table 4a here ]

For the purposes of this paper, I focus on instability in *state* revenues as the measure of interest. State revenues provide the bulk of revenues for district spending on annual operations and salaries, so variation in the unpredictability in these revenues would be visible and salient to districts. In addition, state revenues reflect state budget changes and loss of tax revenues for education during economic downturns. Finally, the proportion of a district's total revenues that come from the state provides a measure of centralization and a degree of reliance on the state.

To this end, I present summary statistics for the time-varying measures of state revenue unpredictability as well. The average residual from a lagged growth model is near 0 (.0004) — as expected, pooling all the residuals from each year for each district would average to zero. Since the goal is to use unpredictability as a time-varying outcome, I want to take advantage of the annual values. However, each year reflects negative and positive unpredictability. To create an outcome measure that reflects the magnitude of unpredictability but does not vary in its sign, I square the residual so that it

is positive and districts can be ranked in terms of instability. The average squared residual is 0.046. However, the range is from zero to 39, suggesting that there are some years in which state revenues were perfectly predictable and some years that were extreme outliers in the extent of change in state revenues that was unpredictable. When I use this measure as an outcome in a regression framework, I use the z-score of the squared residual, so that the point estimates of the predictor variables can be interpreted as change in standard deviation units.

## III. How Does Revenue Instability Vary by State and District Characteristics?

As a first step in analysis of instability, I decompose the variance between the time, district and the state levels to understand whether state or district factors explain a greater proportion of the instability. I do so with a one-way analysis of variance specification in a three-level hierarchical linear model that considers repeated observations of district revenue instability nested within districts, which are nested within states. I have repeated observations of the squared residual for each district.

I find that the majority of the variance in the year-to-year unpredictability is *within* districts, not surprisingly. Table 1.5a shows that the fraction of total variance coming from within districts is 90.3 percent, between districts is 4.5 percent, and the fraction of total variance coming from the states is 5.1 percent. The fraction of variance explained for each level is statistically significantly different from zero.

To determine which districts might experience more instability in state revenues, I examine some state and district conditions that may make some districts more vulnerable to instability than others.

[Table 1.5a here]

### A. State Factors

I examine state factors that may influence instability. Table 1.5b presents results related to state indicators. To address how much the state itself explains district instability in state revenues, I estimate two simple models. One model uses time dummies as predictors; the other model uses time and state dummies as predictors. The results are shown in Table 1.5b. I examine three possible outcome measures: i) the 'naïve' measure

of year-to-year percent change: For this outcome, neither the state nor the state and time effects seem to explain much of the variation; ii) the preferred measure of the fitted residual from a lagged growth: For this outcome, time and state indicators explain slightly more of the variation; and iii) the summary measure of instability from the lagged growth model—the root mean squared error. The percent variation explained by year effects is 63 percent, and increases to 75 percent with the addition of state effects. This increase after controlling for unobserved state characteristics is not surprising, given that the instability is in state revenues and that state finance regimes differ between states.

[Table 1.5b here]

*Proportion of revenues received from the state:* Next, I test the relationship between the proportion of revenues districts receive from the state and the instability districts experience in those state revenues. One might expect that the more a district relies on state revenues, the more exposed they may be to changes in state revenues. High state reliance could provide a district with more information or opportunity to anticipate changes in state revenues, thereby lowering unpredictability for districts with more reliance. Alternately, high state-reliant districts may be hurt more by unpredictability in state revenues.

I start with a simple descriptive analysis. I examine how revenue instability tracks with district share of revenues from the state. The measure of revenue instability I use for the descriptive analysis is the fitted residual from the lagged growth model, which I had fit individually for each district per equation 1.[12] This measure reflects how much of the

[12] Residual ($\hat{u}_t$ ) generated from the model of expected changes [$\Delta Revenues_{t\text{-}1\text{-}t} = \alpha + \beta_1(\Delta revenues)_{t\text{-}2\text{-}t\text{-}1} + \beta_2(\Delta revenues)_{t\text{-}3\text{-}t\text{-}2} + u_t$],

change in revenues could not be predicted by the district. I then square it, so that all the variability is positive, but the relative magnitude between districts is not reduced.

The identification of this relationship cannot occur in a cross-sectional time-series framework. State revenue share, on average, could vary whenever a state revenue shock occurred. For example, if a state experienced a revenue cut approximating $100 per pupil for districts in the state in a given year, that $100 per pupil makes up a larger share of revenues for districts that rely on the state for 80 percent of their revenues than for districts that rely on the state for just 20 percent of their revenues.

Instead, I look at changes over decades. The larger time frame and averages for those decades provide better, though not perfect, identification of the effect of state revenue share changes on instability. To assess the change in the relationship to revenue instability over time, I average the instability outcome measure for each decade—this means I take the residual for each year, and calculated the standard deviation of the residual for that decade. This is akin to the summative, model-based measure I reviewed in section II.A. I also average the state revenue share variable within each district for each decade, to ensure the level of variation of the predictor is at the same time frame as the outcome. In equation (2), subscript *t* refers to decade.

$$(2)\ (\sigma_{\hat{u}_{dt}}) = \beta_1 \overline{(StateRevenueShare)}_{dt} + \alpha_d + \delta_t + \varepsilon_{dst}$$

Table 1.6 presents the results of this model. Since I am using just state revenue data, and not district demographics, I can use more years of data. I start with 1970 and end with 2008, giving me approximately 3.75 decades. I run three specifications: a decade fixed effect, to account for changes that occurred between the decades; a decade

and state fixed effects model, to test the within-state effect on changes in revenue instability associated with state revenue share across decades; and finally a decade and district fixed effects model, to account for changes within a district over the decades. I cluster standard errors at the state-by-decade level.

[Table 1.6 here]

In all specifications, there is a negative relationship between the proportion of revenues from the state and revenue instability. The coefficient estimates decline slightly across specifications: -0.293, -0.279, and -0.248, for decade, decade plus state, and decade plus district effects, respectively. This means that a one percentage point increase in state revenue share is associated with a nearly one-fourth of a standard deviation unit decline in the Root Mean Squared Error (RMSE), which represents the variability of revenue unpredictability over time. The results suggest that higher state responsibility for school funding might actually cushion districts from instability. Next, I consider state revenue share in conjunction with other covariates that may be associated with instability.

B. District Factors

To characterize what kinds of districts are more revenue-unstable over time, I examine the relationship between revenue instability and district geographic and demographic factors. Given the importance of state revenue share, I focus on variables that may be associated with a district's reliance on state revenues.

For geographic variables, I consider whether a district is in the Western U.S., where population has been increasing for many districts and may be associated with categorical grants from the state. I also consider whether a district is in the Southern U.S.,

where districts tend be counties, and therefore may have an intermediary level of government providing funding. To this end, I include an indicator for whether a district is a county. I also consider whether a district is in a metropolitan area, which may be associated with either larger schools or declining-enrollment districts, both factors that may influence state revenue share. I consider whether a district is in a rural area, as that is likely a proxy for a small district that may not receive as much from the state.

As the outcome, I square the fitted residual for each district-year to make the outcome positive, and then standardize this outcome as a z-score. This allows me to see how each district characteristic is associated with the amount of variability (rather than the association with the direction of the prediction error in that year) and to interpret the results in standard deviation units. I enter each of the geographic variables in a model separately, then with all geographic characteristics. Finally, I enter these variables with interactions with state revenue share. In this case, I am trying to explain differences across districts, rather than within districts over time. I cluster standard errors at the district level.

For the time-invariant geographic variables alone, I cannot run a model with state or district fixed effects as the entity-specific indicator will absorb the covariate. I do run a model with a year fixed effect, to control for unobserved year-specific differences, and cluster standard errors at the district level. Table 1.7 shows results for these specifications.

Given that state revenue share is associated with lower instability over time, as shown in Table 6, the interactions between geographic indicators and state revenue share are also negative and significant. The relationship between geographic indicators and

instability is significantly moderated by state revenue share. Districts in the southern part of the United States are slightly less unstable over time, in the individual and full model. But the main effect of being in a southern district changes when I interact it with state revenue share. Southern is associated with a 0.13 standard deviation increase in instability, but state revenue share moderates that effect by -0.27 standard deviation units. Although being a district in the Western U.S. is not significant on its own, it is in the model with the state revenue share interaction. The main effect is associated with a 0.49 standard deviation increase in instability, but this effect is dampened by the interaction effect of -0.395. Similarly, metropolitan districts are not significantly associated with instability in the individual model, but are in the interaction model. The main effect is a 0.23 standard deviation increase in instability, but the interaction effect moderates this by -0.725 standard deviation units. Rural districts are associated with decreased instability in the individual model, but the sign changes in the interaction model. The main effect for rural is 0.16 standard deviation units, which is moderated downward by the interaction effect of -0.32. Districts that are counties are associated with less instability, -0.03 standard deviation units, in the individual model, but are not significant in the interaction model. These results suggest that geography explains some of the variation in instability, but that differences between districts in state revenue share are likely the underlying mechanism for that variation.

[Table 1.7 here]

Next, I examine a set of *time-varying* district characteristics that may be associated with district revenue instability. I estimate the following model:

$$(3)\ z_{(\hat{u}_{dst})^2} = \alpha_d + \delta_t + \boldsymbol{X}\beta_{dst} + e_{dst}\ ,$$

where the outcome is the standardized squared fitted district-year residual from a lagged dependent variable model of differences; $\boldsymbol{X}$ is a vector of district characteristics. The district characteristics I include are proportion of total revenues from the state and those that were summarized in Table 1.1b: log enrollment, student-teacher ratio, and proportion of students eligible for the Free- and Reduced-Price Lunch program. I run this model with district fixed effects (Table 1.8a) and district and year fixed effects (Table 1.8b), to examine the change in the relationship to revenue instability within a district over time. The coefficient estimates from both models are similar in sign, magnitude and significance, suggesting I do not have an omitted variable bias problem at the district level. I use robust standard errors to account for heteroskedasticity.

The results in Table 1.8a show that all the covariates but enrollment are, on their own, significantly associated with changes in instability over time within districts. I discuss the results from the full model with four key covariates: enrollment (to account for size), percent eligible for free lunch (to proxy for student poverty), state revenue share (to account for contribution of state funds), and student-teacher ratio (to control for the staffing and spending obligations in the district).

In this full model, a 1 percent increase in enrollment is associated with a -.28 standard deviation unit decline in revenue unpredictability ($p<.01$). The negative relationship between enrollment and unpredictability supports the idea that larger districts face less revenue instability. This result suggests that even in districts where enrollment is changing over time, larger districts have less instability. The proportion of students eligible for Free or Reduced-Price Lunch is associated with a decline in instability of -

0.15 standard deviation units. The proportion of state revenues received by the district is significant and negatively related to state revenue instability in both specifications, holding other variables constant (-0.534 s.d. units individually and -0.514 with other covariates). This more than half a standard deviation decline in unpredictability echoes the results from Table 1.6 on the decline in unpredictability as state revenue share increased over time. But as alluded to in the discussion for Table 1.6, this may simply reflect that state share changes as state revenues fluctuate. Meanwhile, the student-teacher ratio is associated with a small *increase* in unpredictability of 0.015 standard deviation units. This result suggests that districts with higher pre-determined salary and staff commitments might be in a more precarious position when state revenues are unpredictable over time.

When I include district and year fixed effects, the coefficient magnitudes change in the full specification. Now a 1 percent change in enrollment is associated with a .23 standard deviation unit decline. The percent eligible for free and reduced price lunch is associated with a .11 standard deviation unit decline. The magnitude of the relationship between proportion of state revenues and instability drops from the half a standard deviation decline in the previous model to a 0.37 standard deviation unit decline in unpredictability. The student teacher ratio is .009, quite similar to the .015 in the model without year fixed effects. The change in the magnitude of the state revenue share relationship suggests that instability within a district still declines over time, but that there may be unobserved events occurring in particular years.

[Tables 1.8a & 1.8b here]

As a specification check, I run the model with a summative measure of revenue instability as an outcome, and use time-invariant covariates to see if examining the relationship between instability and district characteristics overall reveals different correlations. In Table 1.9, I verify whether these relationships hold when the outcome variable is a more summative instability measure, the root mean squared error. Because this outcome does not vary by time, the first column includes covariates that are averaged for each district across the years in which the variable appears for that district in the panel. (The average proportion of students who are eligible for Free/Reduced-Price Lunch is collinear with other variables, so the variable is dropped from the model). The second column includes a binary indicator for whether the variable is the top quartile, or in the case of enrollment, in the bottom quartile of all districts. Table 1.9 shows these results.

The biggest change in results is that the average district share of state revenues is larger in magnitude (-0.34 vs. -0. 37 in the fixed effects model in 1.8b). Districts in the top quartile of reliance on state revenues are still negatively associated with revenue instability, but at a smaller magnitude (-0.031), perhaps because I am not accounting for changes over time. Enrollment averaged by districts is negatively associated with average instability. But low-enrollment districts are positively associated with revenue instability (0.02), compared to high-enrollment districts. This confirms results from Table 1.8a that larger districts are less unstable. Districts in the top quartile of proportion of students eligible for the federal free lunch program still have a negative relationship with revenue instability (-.02). And the student-teacher ratio is still positive, but the highest quartile of student-teacher ratio is now small in magnitude (0.006). The confirmation of

results across specifications suggests that the relationship between state revenue share and revenue instability is, indeed, negative.

[Table 1.9 here]

The model with averaged covariates has the highest R-squared at 20 percent of variance explained, suggesting that we can explain variation in state revenue instability better for the average district over its lifetime. The other model has a negligible R-squared statistic. The instability measure generated from a lagged model for each district may not have more *variance* to be explained by covariates, but may still have significant correlations with district characteristics. In addition, as the sample size increases, the R-squared is less likely to increase the percent of variation explained.

## VI. Discussion and Conclusion

This paper presents evidence on measuring revenue instability and the role of state centralization in instability. As the first study to assess district-level revenue instability with a systematic comparison of measures and model specifications, this paper provides researchers and policymakers with initial options for understanding vulnerability and unpredictability within and across districts. I identified a lagged growth model as a stationary specification that purges trends and isolates unpredictability. This process allows me to quantify instability facing districts over a large time span or select periods. This may prove useful to policymakers seeking ways to identify or rank vulnerable districts and employ additional measures of district fiscal health and efficiency in an era of increasing demands for district accountability.

I also provide evidence on district and state characteristics associated with revenue instability. As one might surmise, districts with low enrollment have more over-time instability in state revenues than high-enrollment districts, perhaps reflecting limited ability to adjust staffing or other resources when enrollments fluctuate or pointing to limited district staffing and capacity to adjust between revenue categories. Districts with a high population of students eligible for Free and Reduce-Price Lunch are less unstable, on average and over time. The student-teacher ratio is positively associated with instability, but at a small magnitude. This may suggest that districts with not enough teachers but a changing population of students experience more instability in per-pupil funding from the state.

The most striking finding is that the proportion of revenues a district receives from the state is associated with declining instability over time and less instability on average. This reliance moderates the relationship between geographic characteristics and instability, such that for a given region or type of district, if it has a higher state-revenue share it is less unstable. I explore this relationship between state contribution of funds and instability further in Essay 2.

## Table 1.1a. Summary Statistics: Revenue and Expenditure Levels at the District Unit.[13]

Per-pupil revenue and spending levels in inflation-adjusted 2008 dollars.

| Variable | | Mean | Std. Dev. | Min | Max | Observations |
|---|---|---|---|---|---|---|
| ***Revenue variables*** | | | | | | |
| **Total Revenues** | overall | 9497.025 | 4825.619 | 143.5297 | 120563.1 | N = 290359 |
| | between | | 3858.737 | 1441.803 | 56633.72 | n = 10208 |
| | within | | 3106.602 | -23621.7 | 102846.5 | T-bar = 28.4443 |
| **Federal Revenues** | overall | 476.2613 | 791.9691 | 0 | 47675.15 | N = 290359 |
| | between | | 682.76 | 0 | 17668.5 | n = 10208 |
| | within | | 499.8398 | -15405.6 | 38408.66 | T-bar = 28.4443 |
| **State Revenues** | overall | 4485.746 | 2598.037 | 0.767452 | 76941.42 | N = 290359 |
| | between | | 2038.802 | 242.6961 | 24348.27 | n = 10208 |
| | within | | 1718.59 | -14603 | 72397.52 | T-bar = 28.4443 |
| **Local Revenues** | overall | 3175.061 | 3985.986 | 0 | 95410 | N = 290359 |
| | between | | 2731.995 | 0 | 38467.08 | n = 10208 |
| | within | | 3071.984 | -23558 | 90631.79 | T-bar = 28.4443 |
| **Local Property Tax Revenues** | overall | 3207.276 | 5906.504 | 0 | 2625602 | N = 257995 |
| | between | | 2607.394 | 0 | 78146.7 | n = 10208 |
| | within | | 5285.708 | -73190.7 | 2550662 | T-bar = 25.2738 |
| ***Expenditure variables*** | | | | | | |
| **Total Expenditures** (includes operating, which includes instruction & support) | overall | 9512.62 | 4976.527 | 94.67955 | 120108.9 | N = 290358 |
| | between | | 3802.628 | 1409.588 | 52201.35 | n = 10208 |
| | within | | 3397.488 | -25142.2 | 102134.4 | T-bar = 28.4442 |
| **Operating Expenditures** | overall | 8153.803 | 3860.548 | 0 | 104400.7 | N = 287798 |
| | between | | 3151.111 | 1324.872 | 41361.95 | n = 10208 |
| | within | | 2407.943 | -18366.3 | 95454.95 | T-bar = 28.1934 |
| **Instructional Expenditures** | overall | 5626.462 | 23444.54 | 104.848 | 8469355 | N = 188270 |
| | between | | 6448.011 | 2881.677 | 538331.3 | n = 10128 |
| | within | | 22622.95 | -525106 | 7936650 | T-bar = 18.5891 |
| **Support Expenditures** | overall | 3146.932 | 11351.18 | 0 | 4320759 | N = 188270 |
| | between | | 3048.8 | 1168.56 | 230704 | n = 10128 |
| | within | | 10941.12 | -224883 | 4093202 | T-bar = 18.5891 |

[13] N represents district-year observations, and n represents number of districts in the panel with that variable. T-bar represents the average number of years of data available for this variable, so the minimum and maximum values for the within statistic are time-demeaned. Instructional and support spending data are available only from 1990 onward.

**Table 1.1b. Summary Statistics: Demographic Characteristics.**[14]

| Variable | | Mean | Std. Dev. | Min | Max | Observations |
|---|---|---|---|---|---|---|
| ***Continuous variables*** | | | | | | |
| Percent of total revenues contributed by state revenues | overall | 0.492 | 0.185 | 0 | 1 | N = 290359 |
| | between | | 0.163 | 0.036 | 0.877 | n = 10208 |
| | within | | 0.088 | -0.260 | 1.138 | T-bar = 28.4443 |
| Enrollment | overall | 4015.360 | 14029.520 | 0.0 | 996495.0 | N = 290019 |
| | between | | 15110.310 | 93.5 | 895833.8 | n = 10208 |
| | within | | 2913.536 | -890286.5 | 186198.4 | T-bar = 28.411 |
| Log Enrollment | overall | 7.449 | 1.175 | 1.099 | 13.812 | N = 288093 |
| | between | | 1.174 | 4.515 | 13.414 | n = 10208 |
| | within | | 0.188 | 0.320 | 10.585 | T-bar = 28.2223 |
| Percent Free/Reduced-Price Lunch Eligible | overall | 0.259 | 0.184 | 0 | 1 | N = 209108 |
| | between | | 0.168 | 0 | 0.957 | n = 10130 |
| | within | | 0.080 | -0.559 | 0.949 | T-bar = 20.6424 |
| Student-Teacher Ratio | overall | 15.122 | 3.373 | 0 | 67 | N = 200793 |
| | between | | 2.882 | 3.869 | 39.166 | n = 10130 |
| | within | | 1.877 | -15.743 | 68.248 | T-bar = 19.8216 |
| ***Indicator variables*** | | | | | | |
| **High State Revenue Share:** District receives more than 60% of revenues from state (binary indicator =1 if true) | | 0.259 | 0.438 | 0 | 1 | 290359 |
| **Small District:** Enrollment is below FY2008 bottom quartile | | 0.178 | 0.383 | 0 | 1 | 290019 |
| **High Poverty:** District has more than 36% students who are Free/RP-Lunch eligible (binary indicator =1 if true) | | 0.250 | 0.433 | 0 | 1 | 209108 |
| **High Student-Teacher Ratio** | | 0.234 | 0.424 | 0 | 1 | 200793 |

[14] N represents district-year observations, and n represents number of districts in the panel with that variable. The districts in the demographic sample remain less than or equal to 10,240 in order to match to the fiscal outcome variables. T-bar represents the average number of years of data available for this variable, so the minimum and maximum values for the within statistic are time-demeaned. Demographic characteristics are available from FY1986-1987 onward. For some of the demographic variables of interest, such as per-pupil staff ratios, less than 5 percent of observations contained implausibly large values. In such cases, I top-censored the variable at the highest plausible value (e.g. 100% for percentage variables) rather than impute mean values.

**Table 1.2a. Possible measures of instability.**

| Measure of instability | What it captures | How it is obtained | Limitations |
|---|---|---|---|
| **Residual** | Deviation from the fitted model in each year, or prediction error. | Prediction obtained after I fit a model. | Possible omitted variable bias. |
| **Root Mean Squared Error (RMSE) or standard deviation of the residual**[15] | Square root of the average squared difference between forecast and corresponding observed values.<br><br>Higher values mean more variability. | It is a measure of model fit after model is estimated. | Does not vary by time. |
| **Percent change** | Change in current year compared to prior year. | | |
| **Mean Absolute Deviation**[16] | Calculation of whether revenues in a particular period for a district is more than one standard deviation (in absolute value) from its over-time mean. | | Measure depends on the units, so it may limit comparisons between large and small districts. |
| **Coefficient of Variation** | Typically used to measure between-unit dispersion, I could use this to calculate dispersion in revenues over time within a district.[17] | Standard deviation/mean. | Sensitive to extreme values of distribution. |

[15] Standard Deviation of the Residual is the same as the RMSE for a pooled sample. It differs slightly when a model is fitted for small sample sizes and/or for individual districts.

*Root Mean Squared Error(RMSE)=* $\sqrt{E\left(\left(\widehat{Y}_d - Y_d\right)^2\right)} = \left(\sigma_{d\hat{u}}\right)$ *= std. deviation of residual*

[16] $\frac{1}{n}\sum_{i=1}^{N} |x_i - \bar{x}| > 1\sigma$; Wagner & Elder (2004) use mean deviation from trend.

[17] $\frac{1}{D}\sum_{d=1}^{D} CV_d = \frac{1}{D}\sum_{d=1}^{D} \frac{sd_d}{\mu_d} = \frac{1}{D}\sum_{d=1}^{D} \left[\frac{\left(\frac{1}{T\sum_{t=1}^{T}}\right)(Y_{td} - \bar{Y}_{.d})}{\frac{1}{T\sum_{t=1}^{T}(Y_{t.})}}\right]$

**Table 1.2b. Comparison of instability measures by criteria: Model-based measures meet more criteria than calculated measures do.**

| Criteria | Does the measure capture the *unpredictable* component of revenue fluctuations? | Does the measure itself vary over time? | Does the measure allow for comparisons across districts? |
|---|---|---|---|
| ***Model-based measures*** | | | |
| Residual | Y | Y | Y |
| Standard deviation of the residual (Root Mean Squared Error) | Y | N | Y |
| ***Calculated measures*** | | | |
| Percent change | N | Y | N |
| Mean Absolute Deviation | Y | N | N |
| Coefficient of Variation | N | N | Y |

**Table 1.2c. Comparison of specifications to calculate residual as instability measure.**

| Specification | Approach | Additions | Limitations |
|---|---|---|---|
| ***Model and form of predictors*** | | | |
| **Levels**<br><br>$Revenues_t = \alpha_d + \beta_1(Revenues)_{t-1} + \beta_2(Revenues)_{t-2} + u_t$ | In this option, I use the real, log per-pupil variable for the current period as the outcome, and the 1- and 2-year lags as the predictors. | Tried with multiple lags, but one lag explains almost 90% of variation and is always significant. | Error may be serially correlated over time. |
| **Levels w/ Time Trend**<br><br>$Revenues_t = \alpha_d + \beta_1(Revenues)_{t-1} + \beta_2(Revenues)_{t-2} + \beta_3 t + u_t$ | This is the same model as above, and also controls for overall increase in revenues over time, so that remaining instability is purged of time trends. | Tried with multiple lags, and different specifications of the time trend (linear, quadratic, cubic). Residual from linear time trend correlated at 100% with other forms. | Does not address stationarity. |
| **Growth (Differences)**<br><br>$\Delta Revenues_{t-(t-1)} = \beta_{1d}(\Delta Revenues)_{(t-1)-(t-2)} + \beta_{2d}(\Delta Revenues)_{(t-2)-(t-3)+} u_t$ | Here, I use the growth or change in revenues in past periods as predictors of change in the current period, which captures districts' expected revenue variability in the current period. | The number of lags used for each district varies based on tests for model fit conducted for each district. | |
| ***Sample*** | | | |
| **Pooled** | Puts all districts in the sample together for one model, and see how each district deviates from the prediction using information from all district-years. | Tried with state fixed effects, clustered standard errors at the district level. | May over- or under-estimate the variability that district faces based on its own history of variability. |
| **Individual district-by-district** | Fit a model for each district, and see how it deviates from the prediction using information just for the years that district has the variable. | | May lose efficiency of estimator |

**Table 1.3. Correlation of standard deviation of the residual from different model specifications of state revenues.**

| State Revenues | Lagged growth model | Lagged levels model | De-trended growth | De-trended levels |
|---|---|---|---|---|
| Lagged growth model | 1 | | | |
| Lagged levels model | 0.9829* | 1 | | |
| De-trended growth | 0.9295* | 0.9435* | 1 | |
| De-trended levels model | 0.8381* | 0.8515* | 0.8255* | 1 |

*:All pairwise correlations significant at p<.05

**Table 1.4a. Summary Statistics: Root Mean Squared Error as Time-Invariant Instability Measure for Revenue and Expenditure Categories.**[18]

| Variable | District Obs. | Mean | Std. Dev. | Min | Max |
|---|---|---|---|---|---|
| **Total Revenues** | 10197 | 0.105 | 0.066 | 0.016 | 1.218 |
| **Federal Revenues** | 10115 | 0.356 | 0.280 | 0.037 | 1.886 |
| **State Revenues** | 10197 | 0.163 | 0.124 | 0.017 | 1.924 |
| **Local Property Tax Revenues** | 9330 | 0.149 | 0.109 | 0.017 | 3.330 |
| **Total Expenditures** | 10197 | 0.144 | 0.069 | 0.016 | 1.141 |
| **Current Expenditures** | 10197 | 0.083 | 0.060 | 0.007 | 1.196 |

**Table 1.4b. Summary Statistics: Time-Varying Measure of State Revenue Instability.**

| Variable | District Obs. | Mean | Std. Dev. | Min | Max |
|---|---|---|---|---|---|
| Squared residual from Lagged Growth Model | 10208 | 0.0460 | 0.3421 | 0.0000 | 39.4082 |
| Residual from Lagged Growth Model | 10208 | 0.0004 | 0.2146 | -5.0743 | 6.2776 |

[18] A reminder that the observations are less than 10,224 because I can only calculate the variability for districts with consecutive years of data. If a district has missing data for some years, it is dropped from the instability analysis. Local property tax revenues appear in consecutive years for a smaller number of districts, so the number of observations falls for that variable compared to the rest.

**Table 1.5a. Variance decomposition of revenue instability measured as squared residual shows variability is primarily within districts.**

| | Unit of analysis | Variance component | Fraction of total variance explained |
|---|---|---|---|
| Level 1 | Repeated measures within districts | 0.1475 | 0.9035 |
| Level 2 | Districts | 0.0074 | 0.0452 |
| Level 3 | States | 0.0084 | 0.0513 |

**Table 1.5b. State and time explain more variability in revenue instability than state alone.**

| Measures of instability in state revenues | R-squared from model with year indicators | R-squared from model with year and state indicators |
|---|---|---|
| Yr-Yr Percent Change | 0.041 | 0.043 |
| Yr-Yr Squared Residual | 0.005 | 0.007 |
| Standard Deviation of Residual | 0.631 | 0.753 |

**Table 1.6. State responsibility for district funding is associated with less revenue instability over time.**

| | **Dependent Variable: Standard deviation of the residual from a lagged growth model of state revenues, averaged by decade for each district** | | |
|---|---|---|---|
| | Decade Fixed Effect | Decade + State Fixed Effect | Decade + District Fixed Effect |
| Proportion of revenues district receives from the state, averaged by decade | -0.295** | -0.279** | -0.248* |
| | [0.037] | [0.041] | [0.104] |
| Constant | 0.299** | 0.313** | 0.299** |
| | [0.024] | [0.023] | [0.055] |
| Adjusted R-Squared | 0.125 | 0.212 | 0.214 |
| Number of Districts | 10197 | 10197 | 10197 |

Robust standard errors, clustered at the state-by-decade level in brackets
* p<0.05, ** p<0.01, *** p<0.001

**Table 1.7. Rural and southern districts are associated with state revenue instability.**

| | Dependent Variable: Standardized Squared Residual of Log PP Change in State Revenues | | | | | | |
|---|---|---|---|---|---|---|---|
| south | -0.0530 | | | | | -0.0413 | 0.128 |
| | (0.00464)*** | | | | | (0.00607)*** | (0.0307)*** |
| west | | 0.0113 | | | | 0.00744 | 0.494 |
| | | (0.00922) | | | | (0.0112) | (0.0918)*** |
| metro | | | 0.0179 | | | 0.00968 | 0.331 |
| | | | (0.0186) | | | (0.0195) | (0.122)** |
| rural | | | | -0.0232 | | -0.0176 | 0.157 |
| | | | | (0.00627)*** | | (0.00633)** | (0.0246)*** |
| district is a county | | | | | -0.0348 | -0.0132 | 0.215 |
| | | | | | (0.0123)** | (0.0130) | (0.145) |
| ***Interactions with state revenue share*** | | | | | | | |
| south | | | | | | | -0.271 |
| | | | | | | | (0.0526)*** |
| west | | | | | | | -0.795 |
| | | | | | | | (0.144)*** |
| metro | | | | | | | -0.725 |
| | | | | | | | (0.220)*** |
| rural | | | | | | | -0.322 |
| | | | | | | | (0.0401)*** |
| district is a county | | | | | | | -0.379 |
| | | | | | | | (0.239) |
| Constant | 0.00771 | -0.00625 | -0.00877 | 0.00409 | -0.00515 | 0.0121 | 0.00312 |
| | (0.00358)* | (0.00293)* | (0.00307)** | (0.00425) | (0.00319) | (0.00642) | (0.00652) |
| | | | | | | | -0.379 |
| N | 290282 | 290282 | 216540 | 290282 | 216848 | 216540 | 216540 |
| R-sq | 0.013 | 0.012 | 0.013 | 0.013 | 0.013 | 0.014 | 0.023 |

Robust district-clustered standard errors in parentheses
="* p<0.05 ** p<0.01 *** p<0.001"

**Table 1.8a. Instability varies significantly by district characteristics.**

District fixed effects model.

| | Dependent Variable: Standardized Squared Residual of Log PP Change in State Revenues | | | | |
|---|---|---|---|---|---|
| Log enrollment | -0.017 | | | | -0.276** |
| | [0.012] | | | | [0.024] |
| Pct FRL | | -0.150** | | | -0.151** |
| | | [0.018] | | | [0.016] |
| Proportion of revenues from the state | | | -0.534** | | -0.514** |
| | | | [0.048] | | [0.090] |
| Student-Teacher Ratio | | | | 0.007** | 0.015** |
| | | | | [0.001] | [0.002] |
| Constant | 0.118 | 0.033** | 0.258** | -0.123** | 2.107** |
| | [0.089] | [0.005] | [0.024] | [0.018] | [0.183] |
| District Fixed Effects | Y | Y | Y | Y | Y |
| Number of Cases | 288016 | 209031 | 290282 | 200737 | 193639 |
| Number of Districts | 10196 | 10118 | 10196 | 10118 | 10118 |
| R-Squared | 0.088 | 0.112 | 0.088 | 0.120 | 0.126 |

Robust standard errors in brackets

**Table 1.8b. District characteristics explain variation in unpredictability in state revenues between and within districts.**

District and year fixed effects model.

| | Dependent Variable: Standardized Squared Residual of Log PP Change in State Revenues | | | | |
|---|---|---|---|---|---|
| Log enrollment | -0.024* | | | | -0.233** |
| | [0.012] | | | | [0.025] |
| Pct FRL | | -0.098** | | | -0.113** |
| | | [0.019] | | | [0.016] |
| Proportion of revenues from the state | | | -0.437** | | -0.368** |
| | | | [0.046] | | [0.090] |
| Student-Teacher Ratio | | | | 0.003+ | 0.009** |
| | | | | [0.001] | [0.002] |
| Constant | 0.123 | -0.061** | 0.436** | -0.129** | 1.682** |
| | [0.091] | [0.006] | [0.041] | [0.022] | [0.182] |
| District Fixed Effects | Y | Y | Y | Y | Y |
| Year Fixed Effects | Y | Y | Y | Y | Y |
| Number of Cases | 288016 | 209031 | 290282 | 200737 | 193639 |
| Number of Districts | 10196 | 10118 | 10196 | 10118 | 10118 |
| R-Squared | 0.100 | 0.125 | 0.100 | 0.133 | 0.138 |

Robust standard errors in brackets

**Table 1.9. Relationship between summative revenue instability and time-invariant district characteristics.**

| | Dependent Variable:RMSE from lagged growth model of PP State Revenues | |
|---|---|---|
| | Average covariates | Binary covariates |
| Enrollment^ | -0.009** | 0.020** |
| | [0.001] | [0.003] |
| Poverty: Pct Free/RP-Lunch eligible | 0.000 | -0.022** |
| | [.] | [0.002] |
| Proportion of revenues from the state | -0.339** | -0.031** |
| | [0.010] | [0.002] |
| Student-Teacher Ratio | 0.000 | 0.006** |
| | [0.001] | [0.002] |
| Constant | 0.390** | 0.170** |
| | [0.009] | [0.002] |
| Number of Cases | 290282 | 193646 |
| Number of Districts | 10197 | 10119 |
| R-Squared | 0.197 | 0.024 |

Robust district-clustered standard errors in parentheses

^: 1st column is average log enrollment; second column is the bottom quartile of enrollment; Binary covariates: state revenues, poverty and student-teacher ratio >75th percentile; Enrollment<25th percentile.

# APPENDIX

**Table A1.1 NCES Data Sources and Variables by School District.**

| Fiscal Years | Fiscal variables | Source |
|---|---|---|
| 2003-present | • Federal, state, local revenue by source and by earmark<br>• Spending on general instruction, operating programs, administration<br>• Spending on salaries for instruction vs. support services | Local Education Agency Finance Survey (F-33) Annual Data |
| 1990-present[19] | • Federal, state, local revenue by source | Local Education Agency Finance Survey (F-33) Annual Data |
| 1990-2002 | • Federal, state, local revenue by source and by earmark<br>• Spending on general instruction, operating programs, administration<br>• Spending on salaries for instruction vs. support services | Longitudinal School District Fiscal-Nonfiscal Detail File |
| 1983-1990 | • Local school system tax revenues<br>• State revenues to Elem-Sec districts<br>• Elementary-Secondary Education Current Operating Expenditures, Instructional Expenditures | Historical Database on Individual Government Finances (IndFin) |

[19] 1991, 1993 and 1994 do not have detailed data by revenue source.

| Fiscal Years | Demographic variables | Source |
|---|---|---|
| 1999-2008 | ▪ Enrollment by race, gender<br>▪ Percent children receiving free/reduced-price lunch<br>▪ Total teachers<br>▪ Number of schools<br>▪ Grade distribution | Public Agency Universe Survey |
| 1990-2002 | ▪ Enrollment by race<br>▪ Percent children receiving free/reduced-price lunch<br>▪ Total teachers<br>▪ Number of schools<br>▪ Grade distribution | Longitudinal School District Fiscal-Nonfiscal Detail File |
| 1987-1998 | ▪ Enrollment by race<br>▪ Percent children in poverty<br>▪ Total teachers<br>▪ Number of schools<br>▪ Grade distribution<br>▪ Number special ed students | Longitudinal Common Core of Data Local Educational Agency File |

# Causes of Instability:

# The Effect of State Funds on District Revenue Instability

## I. Introduction

The restructuring of school finance in the U.S. over the past two decades, away from localities and toward state centralization (Loeb & Strunk, 2007; Koski & Reich, 2007), provides a critical context in which to examine the effect of state funds on district revenue instability. In the effort to redistribute funds more evenly among districts, and to meet an increasing number of student and teacher performance requirements, state revenues have increased from 41 percent of district revenues on average in 1970 to almost 51 percent on average in 2000.[20] The increase in state revenues could increase or decrease revenue instability for districts. Revenue instability could increase because state centralization tends to involve a heavier reliance on a sales- and income-tax base rather than a property-tax base. But the increase in state revenues could also decrease revenue instability: while a large share of state revenues goes to schools, it is not necessarily as large a share as local revenues for all districts. The state could smooth some of the revenue instability in its overall tax base by changing spending in other areas or by equally distributing the revenue instability across districts. In particular, finance equalization may make revenues smoother over time, by pooling district-level idiosyncratic instability in a form of mutual insurance. Of course, this arrangement may still leave districts exposed to state-level funding shocks, in some cases even more so than in the absence of equalization.

Prior studies of school district fiscal stress have suggested both unstable revenues and misallocation of available resources were pathways to fiscal stress, but have not

[20]State revenues are defined here as the National Center for Education Statistics classification of revenues from state, not federal pass-throughs or local property taxes that may be determined by the state. If the analysis included those categories, the percentage of state revenues and the increase in the share of state revenues would be even higher. The reliance on state revenue sources varies within and between states (as I discuss in section IV) suggesting that it is not just one or two states driving the increase over time.

separated the mechanisms (DeLuca, 2006; Ahearn et al. 2009). A number of studies have confirmed that limitations on expenditures or raising new revenues present a fiscal constraint that binds for some districts more than others (Downes & Figlio, 1999; Mullins, 2004; Figlio & Rueben, 2001). What remains unclear is whether variability within the existing revenue limit presents another, implicit fiscal constraint. Just as expenditure limitations prevent local government's ability to meet local constituents' desires (Mullins), I argue that revenue instability creates a similar but implicit fiscal constraint on the district to fulfill commitments and meet the needs of local parents, teachers and the district's other 'constituents.'

The primary research question this paper asks is: *Does change in state policy, in particular the contribution of state funds to the school finance system, affect change in district revenue instability?* First, I consider the choice of tax base to fund education as a policy in itself. I examine the role of the tax base in the state-revenue instability that districts experience. Second, I use an interrupted time series design to test whether the contribution of state funds to the school finance system, and specifically school finance equalization, increased or decreased revenue instability.

The rest of this paper is organized as follows: In Part II, I review the prior literature and the mechanisms I will test. In Part III, I discuss the identification strategy I use and the analytic sample I select for the interrupted time series evaluation. I discuss results in Part IV, and conclude in Part V.

## II. Prior Literature and Mechanisms of Interest

While revenue instability has been studied for states as a whole (Clemens, 2011; Sobel & Holcombe, 1996) it has not been studied systematically for school districts. In this section, I briefly review key mechanisms that may influence changes in revenue instability for districts over time: the state tax base and school finance policies. Theory suggests both mechanisms may affect revenue instability. Each mechanism could affect instability positively or negatively, making an ex-ante conclusion about the direction of increases or decreases in instability unclear.

*Tax base:* First, I consider the role of the tax base. As states fund education with increased reliance on state sales and income taxes, revenue instability may increase for districts. Tax stability studies provide consistent empirical evidence that property taxes (local taxes) are more stable, while income and sales taxes are more volatile (Sobel & Holcombe 1996; Poterba 1994; Dye and McGuire 1991). Despite the recent crash in property values in some locales, the property tax base for a county or state is likely still fluctuating less than the sales and income tax base, especially over a 10- or 30-year time span (Vasche &Williams 2005). Edgerton et al. (2004), in a case study of New York City's budget crisis, emphasize that revenue structures that rely heavily on personal income taxes produce excess fluctuations or instability beyond what budget officers could predict. Yet the shift toward more volatile income and sales taxes is precisely what many state school finance systems adopted in pursuit of finance equalization. Income taxes as a revenue source are particularly pernicious for revenue stability because they tend to respond quickly to downturns in the economy, such that the income tax base is unpredictable from year to year and that unpredictability is larger than budget models can

typically forecast. States may pass on these revenue shocks to districts – in effect, the district's budget constraint shrinks as the state's budget constraint does. This is the hypothesis I test.

Table 1a presents summary statistics for the proportion of total taxes collected from sales, income, property and other taxes from 1970-2008. Sales taxes make up 51.6 percent of total tax collections. Income taxes, which exist in 40 of the 46 states in my sample, make up 34.5 percent of total tax collections.[21] Property taxes make up a mere 1.6 percent, since it is a local tax that is returned to the state in rare instances. Other taxes, which include licensing taxes in some states as well as inheritance taxes, make up 12 percent of total tax collections.

In Table 1b, I calculate the average instability for sales, income and property taxes, respectively, for districts in my sample. As a measure of instability, I use the standard deviation of the residual, a summative measure of the variability in year-to-year unpredictability that a district experiences, which I described in Essay 1. I tabulate this measure of instability for all the years in my dataset (1970-2008), and just for the years in which policy change and a shift toward sales and income taxes was occurring (1978-1999). I find that property taxes are, indeed, more stable, as suggested by the literature. For reference, state revenues had an instability measure 0.163 standard deviation units. Property taxes have an instability measure of .003 standard deviation units, close to zero variability and less than 2 percent of the instability districts experience in state revenues. By contrast, sales and income taxes have an instability measure of .016 and .015 standard

[21] States without income tax are: Florida, Nevada, Ohio, Texas, Washington and Wyoming.

deviation units, respectively. That represents 11 percent of the instability measure for state revenues.

[Tables 1a and 1b here]

*Centralization of school finance:* Second, I consider the role of the state as a potential influence on revenue instability. In recent decades, state responsibility for schools has increased, both in terms of finances and student achievement. In addition, many states have adopted policies of school finance equalization to ensure more equal per-pupil spending. Such school finance policies have de facto taken the form of increased state responsibility – through redistribution of state funds between districts and consolidating revenue-raising capacity at the state level. One possible consequence is that states that assume more financial responsibility may be able to use their resources to buffer districts against revenue instability, as compared to earlier periods in which districts bore primary financial responsibility.

An alternate consequence is that centralization of school funding exacerbates revenue instability for districts. Centralization through finance equalization has limited the extent to which some districts can raise local revenues, by capping property tax rate increases or requiring supermajorities to pass parcel taxes. In effect, centralization has increased reliance on state revenues. This reliance on state revenues may not always buffer districts from revenue instability. Vanyolos (2005) finds that 25 percent of districts in New York overestimate state aid for the upcoming fiscal year when confronting uncertainty about state aid. The New York analysis finds that the more a district depends on state aid, the more difficulty it has predicting future aid. This finding supports the idea

that reliance on state revenues may amplify the degree of revenue instability districts experience.

Note that studies specifically assessing school finance equalization have examined district *spending* as the outcome of interest, but not characteristics of district *revenues* after equalization. Such studies typically assess whether a reform increased spending for all districts (so-called leveling-up), or decreased spending to a minimum for all districts (so-called leveling-down). These studies assess whether finance reform changed the local tax price, or the cost to the district of increasing spending. Here is a brief summary of key studies of district-level spending equality post-reform. Murray et al. (1998) examine the effect of court-ordered reform on within-state inequality. They find reforms raise spending for poorer districts, while spending among the rich districts remains the same (a 'leveling-up' effect). Inequality within states is minimized. Between-state changes in inequality are greater. Card & Payne (2002) find that reforms that increased state aid to poorer districts increased spending in those districts, ultimately narrowing the spending gap.[22] Hoxby (2001) looks specifically at the tax price and classifies reforms as pro-spending or anti-spending. She finds substantial variation among states: those with efforts to level-up spending tend to equalize spending moderately while states that level down spending tend to equalize spending more. Hoxby finds that the income or sales tax rate that supports equalization has no significant effect on per-pupil spending. Note that the focus of these studies was not a change in the composition or stability of state or district revenues. Note also that the samples for these studies ended in 1990 or 1992. While the various reforms were designed to narrow the gap in per-pupil

[22]The authors use district-level data from the 1977 and 1992 Census of Governments, merged with district characteristics from the 1980 and 1990 Censuses of Population.

revenues between rich and poor districts, they were not intended to even out any *instability* in revenues either within or between districts, so it is unclear whether instability might be evenly distributed among districts.

In sum, the literature does not provide clear evidence on whether the tax base, state responsibility, or both are mechanisms influencing revenue instability. And the literature is not consistent on whether district reliance on state funds (as a consequence of increased state responsibility for funding education) would expose districts to more or less variability in revenues over time. Thus, it is useful to pursue an empirical test of whether increased responsibility for school funding through both finance equalization and reliance on state taxes increased instability.

## III. Identification Strategy and Data

In this section, I review the goals for the analysis and identifying a causal mechanism that could affect revenue instability. I discuss the issues and challenges in estimation, and propose a solution that uses an Interrupted Time Series Analysis model. I conclude with a brief description of the data.

*Goal:* Although one would ideally like to randomly assign districts or states to policy conditions, it is difficult to find such random assignment related to school finance in particular. The analytical goal is to identify a causal mechanism that approximates random assignment and that is logically linked to state-revenue instability, the outcome of interest. Thus, I need to find a change that 1) could affect not just district revenue levels, but also revenue fluctuations, 2) could have changed the *trend* in that revenue instability between two time periods, 3) is not confounded with other changes or factors that influence changes in revenue instability, and 4) occurred as a random or as-if random change at a discrete time point.

*Issues:* Prior literature and analysis I conducted in Essay 1 provides some potential candidates, but also introduces some potential challenges to identification. Results from Essay 1 suggest that state revenue share is associated with a decline in revenue instability over time. In the models relating state revenue share averaged by decade to instability averaged by decade, the effect is around a one-fourth of a standard deviation decline in average instability within a district over time. This result appears to support requirements 1 and 2. But one might be concerned that states where state revenues make up a larger proportion of districts' total revenues may also be states that differ in observable or unobservable ways that could also influence revenue instability.

For instance, districts in states with higher revenue share may have larger districts, which likely mitigates revenue instability, based on evidence from Essay 1 about the negative relationship between district size and instability. High state-revenue share states may also have certain budget institutions or limitations that may exacerbate revenue instability for districts. Thus, state revenue share alone does not fulfill requirement 3 or 4.

Another candidate for a causal mechanism is the tax base. Tax stability studies show that state taxes are associated with more volatility in state revenues, which meets requirement 1. And a change in the tax base could change instability over time. Yet a state's choice of tax base may reflect political priorities or voter preferences that may be correlated with revenue instability. So a change in the tax base by itself may fulfill requirements 1, 2, and 4, but not 3.

*Solution:* One solution to these challenges is to exploit a dramatic policy change that is plausibly exogenous across states and in which assignment of states to the policy condition is completely understood. This approximates the random assignment goal. If I can use within-state, over-time variation in uncertainty instigated by the policy adoption, I can assess changes in trend over time. And building on prior literature and analysis I conducted, it would be ideal if this policy condition somehow combined both mechanisms of state involvement in funding school districts: increased reliance on a state-tax base, and increased centralization of school funding such that states contributed a greater share of revenues to school districts. The presence of these mechanisms would assure me that any change in instability I observe is related to these mechanisms and not unobserved or confounding factors.

It turns out that in some states, school finance equalization was a policy change that not only changed the state contribution for some districts but also shifted the tax revenue source toward state taxes. By shifting funds away from local property taxes, the change in the tax base for education toward *state* taxes "assigned" some states to increase state responsibility for funding school districts. Since equalization involved changes in state revenue share and taxation that we believe influences district stability, it acts as a state-level intervention that meets the requirements for potentially affecting district-level revenue levels and instability and changing the trend in instability.

However, one cannot assess the effect of this change on instability in just one state. I need a policy condition that is plausibly exogenous across states, and ideally is implemented across multiple states in multiple years, to ensure that any change in instability is indeed a policy effect, and not confounded with the adoption year or unique to the state of policy adoption.

*Methodological Assumptions and Limitations:* The analytic method I choose is an interrupted time series (ITS). It is well-suited to examine districts with repeated measures over time and that experience an intervention that continues into the future. Think of finance equalization as a treatment that is introduced in different states in different years, as if each state were a block in a randomized trial that was phased in across blocks. The use of such a multiple-treatment-group framework to measure change in a revenue outcome within equalization states is a novel application in the school finance literature. ITS improves upon a simple difference-in-difference or regression discontinuity design by examining changes in slopes as well as intercepts, i.e. changes in revenue trends as well as levels.

A key assumption for my study to satisfy ITS conditions is that in the absence of finance equalization, a district's revenue *trajectory* would not have changed significantly after the policy-adoption year. District revenues would have continued to fluctuate as they did prior to the policy. I recognize this is a strong assumption. The counterpoint to my argument is that equalization policies might have been the consequence or culmination of a long-term shift in revenue trajectory, such that revenue instability could have changed even more, had it not been for adoption of school finance equalization.

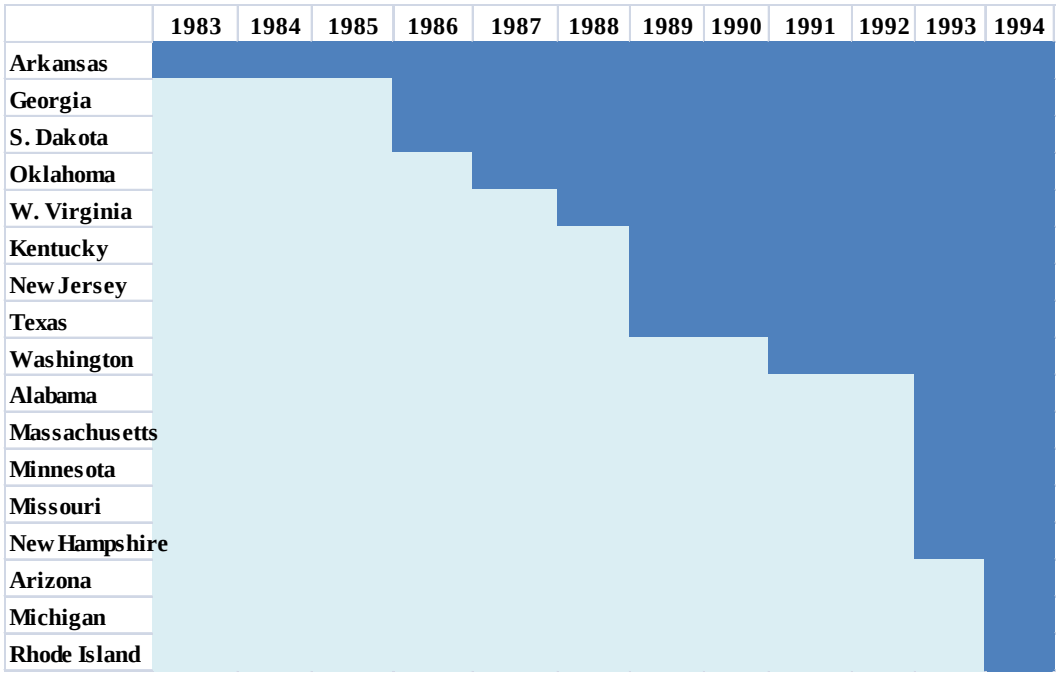
Based on the assumption about the revenue trend, identification of the causal mechanism is based on the *timing* of when different states adopt the policy or enter the treatment group. I want to evaluate whether the district revenue instability level and trend changes once a policy is adopted in a state—once the state enters "treatment." Within a state, I use the state's 'pre-policy' revenue trend as a counterfactual for the post-policy period. Between states, I use the pre-policy revenue trend for all states that have not yet adopted the reform as a counterfactual for the states that did adopt finance reform.

Figure 2.1 presents this study design. The pre-policy trend is in light bars and serves as the control; the post-policy trend is in dark bars and represents the "treatment." For example, the state that adopts the policy first is the first treatment group and all other states are the control. In the next year, the state that adopts the policy joins the treatment group consisting of the state that already adopted the policy. All remaining pre-reform states are the control. I focus on the 17 states that adopted equalization schemes at discrete time points in the 1980s and 1990s, in order to have sufficient years before and after reform to construct a revenue trend. Because all of the states listed in Figure 2.1 ultimately adopted both the tax base change and the centralization of school funding, they

may be more appropriate controls for each other than states that did not centralize or states that did not adopt a tax base change. The list of states is further described in Appendix Table A2.1.

**Figure 2.1. Timing of Policy Treatment in Interrupted Time Series for States Adopting School Finance Equalization in the 1980s and 1990s.**

**Light blue bars indicate control group; Dark blue bars indicate treatment group.**




Ideally, one would have a comparison group of states. However, there are no states that experienced neither a tax base change nor a change in state contribution to district funding, so a true comparison group is not available. Though many states experienced school finance reform, not all of them shifted their tax base toward state taxes at the same time. The states that did not adopt equalization supported by sales and income taxes differ significantly in terms of their demographics, percent of state contribution to school finance, and other key characteristics that would be correlated with

outcomes of instability. As a result, they do not meet the assumptions required to serve as a non-equivalent comparison group in the ITS model. I acknowledge that other states, such as New York and Pennsylvania, ultimately did achieve some sort of de facto finance equalization without legislative policy change. But the absence of a defined date of change makes it difficult to identify a policy effect for such states and clearly assign those states to either treatment or control groups. Given variation in the timing of policy change across states, it is unlikely there is a single alternative mechanism driving a change in revenue trends for all states, making an ITS model a practical quasi-experimental approach.

I use the following model to evaluate the change in instability after the combined change in the tax base and state contribution of funds related to equalization:

(1)

$$z_{\hat{u}_{dst}} = \pi_0 + \pi_1[f_{ds}(t - t^*)] + \pi_2 \text{DuringTreatment}_s + \pi_3 \text{AfterTreatment}_s + \pi_4[f_{ds}(t - t^*) * \text{AfterTreatment}] + \delta_s + \tau_t + \varepsilon_{dst}$$

The outcome is the fitted residual from the lagged growth model for each district *d* in each state-year, *st*. I standardize this residual into a z-score across the sample of 4,369 districts so that it is in standard deviation units, allowing for easier interpretation of effects.

I center the policy adoption year t* at zero (t-t*) for each state, because each one adopted their policies in different years. Centering allows for easy comparison of treatment effects across states and ensures that I do not confound a year effect with a policy effect. I also restrict the data to 10 years before and after the treatment to construct a time trend. I use $f_{ds}$ to represent the functional form of the time trend in district *d* and

state *s*. In the results section, I discuss whether a linear or quadratic form of the time trend fits the data better.

I use $\pi_2$, the coefficient on the reform indicator variable called During Treatment, to capture turmoil associated with the years immediately preceding and after the reform. One would expect there to be a change in instability in state revenues, given that state involvement in district funding increased. This is expected change rather than instability. This parameter accounts for an initial increase or decrease in revenue levels, and using it as a control avoids confounding the initial change in revenue levels with the post-policy instability level or trend. I need to purge this immediate and expected policy shock to revenues in order to assess whether the instability level is higher or lower after equalization than before. If I did not control for the policy period and instability jumped significantly in the year after the policy, then I may erroneously estimate a steep, downward slope simply because the slope would have a high intercept at year 0. However, I do not claim that this parameter removes all upward bias that could inflate the post-treatment effect.

I use $\pi_3$ to capture the post-policy change in average instability. Once I control for the "during treatment" period with $\pi_2$, then $\pi_3$ allows me to isolate whether average instability is greater or less than it was before equalization entered the policy conversation. The parameter $\pi_4$ represents the interaction term between the after period and the time trend, or the change in the instability trend (slope) for districts after the state adopts the reform and change in the tax base, controlling for the policy shock. The point of the exercise is to assess whether states were better off in terms of decreased instability levels, or whether the policy had little long-term significant change in instability.

Before proceeding with the ITS analysis, I have to formally test whether a given tax source itself is associated with change in instability. If an underlying change in districts' state-revenue instability exists over time, I would need to control for this. Identification would be cleaner if the tax base itself is not associated with instability, but rather the change in the tax base associated with the discrete policy change were driving changes in the instability trend.

I focus on state sales and income tax bases, since literature suggests that is more associated with revenue instability. I use a summative measure of revenue instability, the standard deviation of the average residual for each district *d* in decade *t*, as the outcome in equation (2). $Y_i$ refers to the proportion of total tax collections from either income or sales tax, averaged by decade *t* for each district *d*. I cannot use a cross-sectional time-series analysis, since the change in tax base in a given year is likely confounded with the change in revenues for that year, so estimates of a change in instability will likely be inflated. I use a decade fixed effect $\delta_t$ to account for unobserved differences between districts within a decade in the first specification. I add a district fixed effect $\alpha_d$ to capture changes over time within a district in the second specification. In the final version, I use state indicators instead of a district fixed effect to allow me to control for unobserved state policy constraints relating to the association between the tax base and revenue instability for each state over time.

$$(2)\ (\sigma_{\hat{u}_{dt}}) = \beta\overline{(FractionTaxCollectedFromY_i)}_{dt} + \alpha_d + \delta_t + \varepsilon_{dst}$$

*Data:* The revenue data for this study come from the National Center for Education Statistics' Common Core of Data, F-33 district-level fiscal file. All revenue

data is CPI-U adjusted in 2008 dollars for ease of interpretation. I collect state tax collection data from the U.S. Census Bureau's Annual Survey of State and Local Government Finances. Identification of 17 states that equalized with a tax base change comes from several prior analyses of school finance equalization[23], as well as my review of websites of state departments of revenue and education. Note that the state sample includes states from all regions of the country. The sample starts after the 1982 economic contraction and includes the 1990-91 economic downturn.

These states represent 4,369 districts. Summary statistics for these districts averaged for the time period are in Appendix Table A2.2. There is enough variation in district size and student demographics that the policy is not necessarily associated with a particular district characteristic. Based on two-tailed t-tests, these districts do differ significantly from the non-equalization states on all the demographic characteristics presented at the 5 percent significance level. It is not surprising that these districts differ from non-equalization states, given that these states made different choices that could have influenced or been a response to the demographic composition of the districts. However, I do not use these covariates in the analysis, nor do I seek to generalize from the "treatment" states to other states.

[23] See, for example, Murray, Evans & Schwab (1998); Hoxby (2001); and Card & Payne (2002).

## IV. Results

I first present results of the analysis relating the tax base to revenue instability by decade. Then I present visual evidence of the relationship between state revenue share and instability. Finally, I present results of the Interrupted Time Series Analysis for the state sample described earlier.

### *A. Tax base*

In this section, I examine whether the tax base averaged by decade is related to state revenue instability averaged by decade, and whether that relationship changes within states over time. I want to verify whether there is an underlying trend or relationship that I need to control for in the ITS analysis.

Tables 2.2a and 2.2b shows results from specification (1), with the proportion of taxes collected from sales and income taxes as predictors. The marginal effect of the proportion of taxes collected from any source by decade is not significantly associated with average instability in any of the fixed effects specifications. In Table 2.2a, I show results for the relationship between the sales tax base and instability. Note that that the coefficient sign and size changes across specifications. In the decade fixed effects model, the relationship is positive. But once I include district or state fixed effects, the relationship is negative. In addition, the point estimate on the sales tax source in the model with decade and state fixed effects is five times as large in absolute value as the point estimate from the model with decade and district fixed effects (-.047 vs .008, respectively). The increase when accounting for within-state factors is not surprising given that sales taxes are state taxes.

In Table 2.2b, I show results relating collections from income taxes by decade to instability by decade. Again, the marginal effects are not significant. But the movement in point estimates is notable. The coefficient sign is negative in the decade fixed effects model, but positive in the models with district or state fixed effects added. Similar to the results for sales tax, the relationship between the income tax base and instability in the decade and state fixed effects model is twice as large as in the decade and district fixed effects model. Recall that six states do not have income tax: Florida, Nevada, Ohio, Texas, Washington and Wyoming. So the income tax base in those states is zero, which may explain why the relationship between the tax base and instability is not significantly different from zero.

[Tables 2.2a and 2.2b here]

These results should be interpreted with some caution, as the predictor variables are general state tax collection figures from the U.S. Census Bureau's Annual Survey of State and Local Government Finances. Tax collections specifically for education are difficult to identify and compare across states due to different allocation rules. The revenue instability outcome is my calculation from school district-level data from the U.S. Department of Education Common Core of Data.

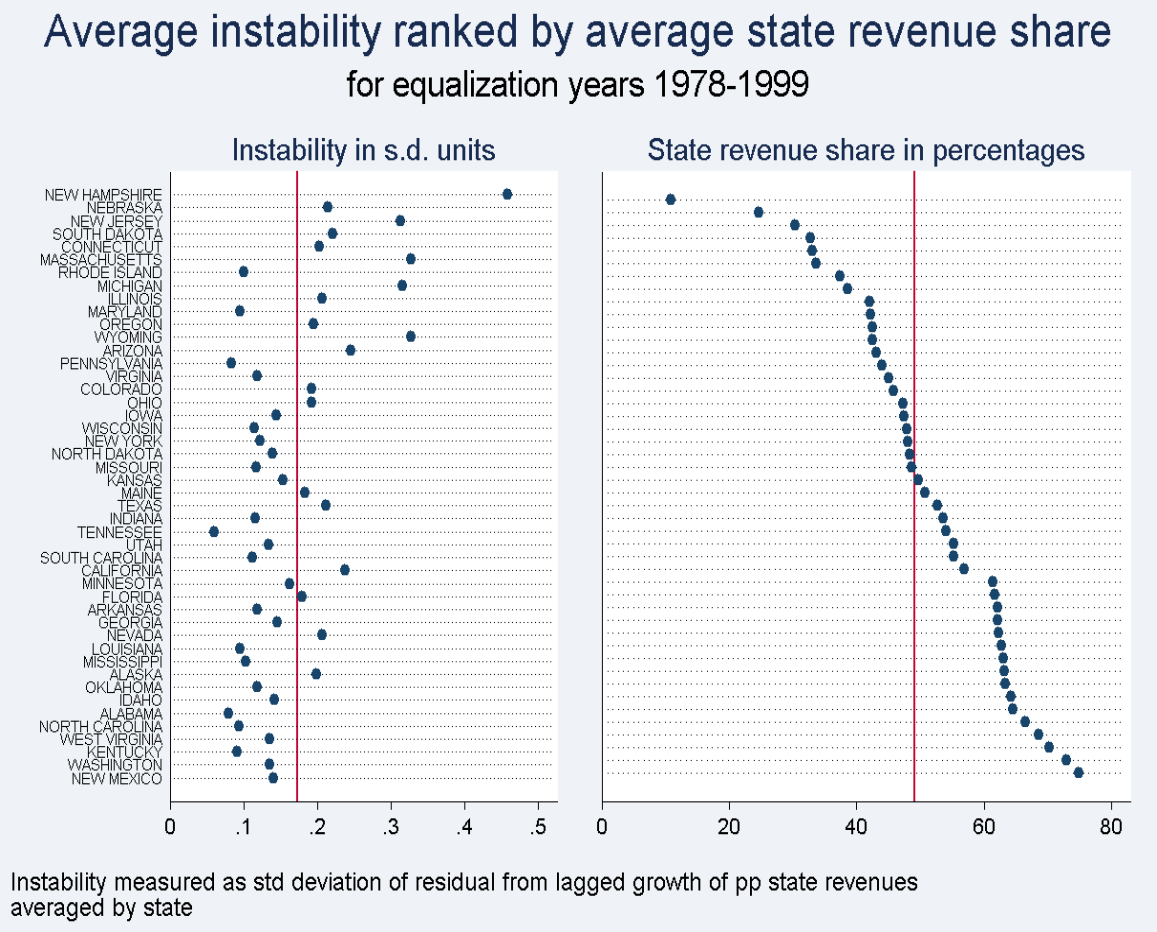
The results suggest there is not an underlying relationship between the tax base across decades and instability. This allows me to pursue the idea that a *change* in the tax base associated with finance equalization assigns states to a new treatment condition of increased state responsibility.

*B. State Revenue Share*

Next, I want to assess the relationship between districts' state-revenue instability and the proportion of revenues they receive from the state. I calculate the percentage of district education revenues received from the state, averaged across districts in each state. Similarly, I calculate the standard deviation of the residual for each district, and average this summative measure of instability for each state. In Figure 2.2, I plot the relationship between these averages for all states, over the 21 years for which I examine equalization reforms for my sample states (1978 is five years prior to equalization in Arkansas, the earliest state in my sample; 1999 is five years after equalization in Michigan, which is the latest state in my sample). I rank the states in ascending order of state revenue share along the vertical axis. The left side plots the average instability measure corresponding to each state, with a red line at the sample mean. The right side plots the state revenue share for each state, with a red line at the sample mean. On average, states with higher state responsibility (those to the right of the red line for state revenue share, or greater than 50 percent state revenues) tend to have lower or similar revenue instability as states with lower state responsibility. This graph confirms the results from Essay 1 that districts with high state revenue share tend to have lower state-revenue instability.

**Figure 2.2. States with Higher Contribution of Funds Have Lower State-Revenue Instability.**

Sample mean for each variable indicated with vertical red line.

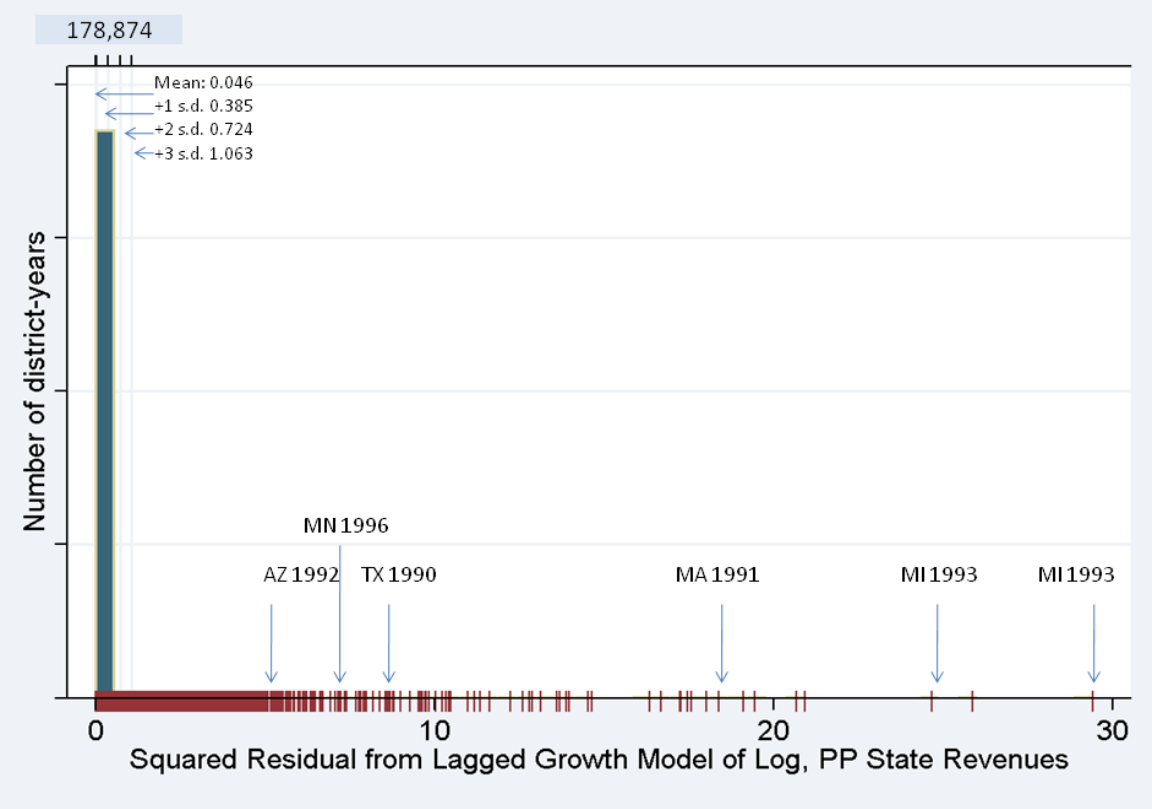



Of course, Figure 2.2 sacrifices much of the variation in the data over time and across districts for ease of visually depicting the negative correlation (-0.108, $p<.05$). In Figure 2.3, I show the distribution of the revenue instability measure at the district-year level, meaning each district will have roughly 20 time points plotted in the histogram. This is useful to identify years of extreme unpredictability in revenues. Of the approximately 180,000 district-year observations, 99 percent of them are near zero. The bars to the right of the first bar show the number of districts with increasingly higher instability. There are more than 1,100 district-year observations beyond the third standard

deviation point. These represent districts that experienced extreme unpredictability in select years. What is striking is that those observations with extreme values manifest in states that pursued finance equalization. Moreover, those observations correspond to the years immediately preceding or following the policy adoption in such states. For instance, Texas adopted its finance reform in 1989; in the subsequent year, we see districts with extreme unpredictability (26 times the standard deviation). Such unpredictability is to be expected in the year following a redistribution of funds. More interesting, however, is that the most extreme values belong to a few districts in Michigan in 1993, the year *before* its finance reform was adopted. This may suggest an anticipation effect or other turmoil leading up to a major change in state contribution of funds to education. These results suggest that the equalization policy created its own type of shock that may be quite separate from the potential shocks from the shift in the tax base, as one might expect. Thus, it will be important to distinguish these two sources of change in the ITS analysis.

**Figure 2.3. Higher unpredictability (larger squared residual) manifests in district-years immediately before or after equalization in key states.**

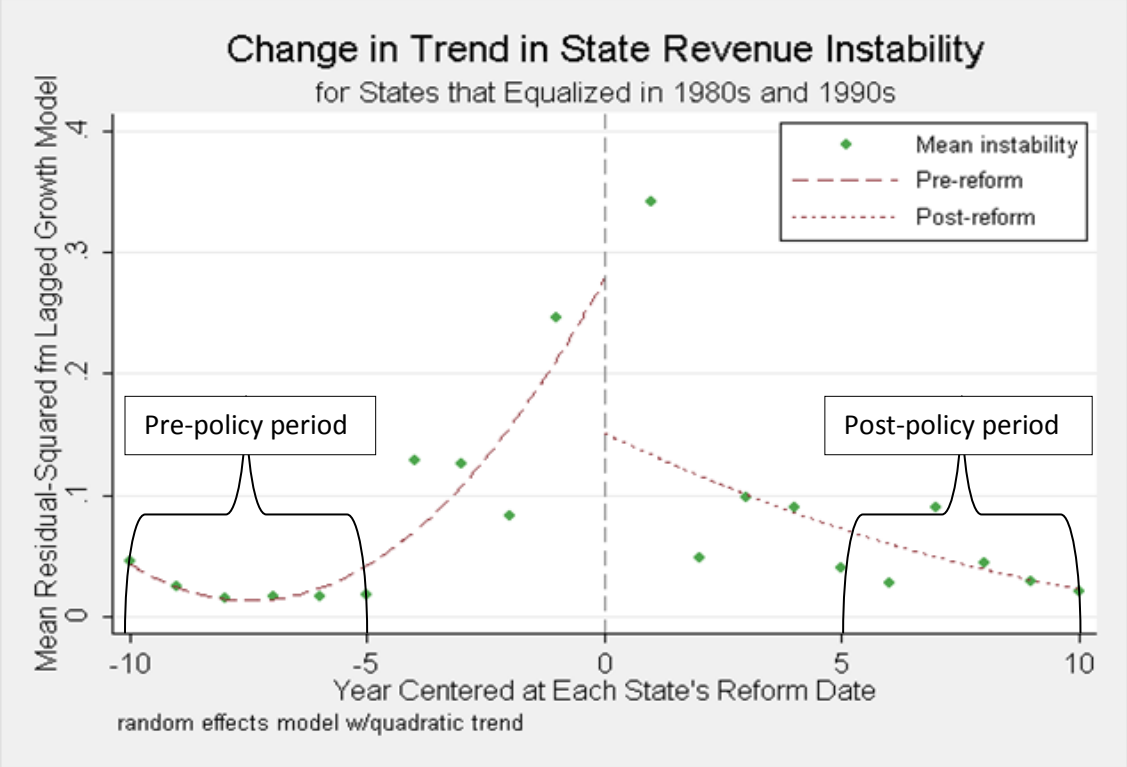
Squared residual from 1978-1999 with indicators for states corresponding to high values. Each " | " corresponds to one district-year.




The extreme unpredictability surrounding the policy adoption years is also evident in a model-based graph that includes these policy adoption years, as shown in Figure 2.4. In the pre-equalization period, when states relied more on the property tax base, districts experienced revenue instability perhaps related to the uncertainty or speculative nature of the property market in the 1980s. In the transition to a new tax base and/or finance formula, the unpredictable component of revenues increases prior to the reform, perhaps suggesting some policy turmoil in the states associated with state funding of schools. After the policy, instability initially increases but then diminishes within a few years. The reversal of the revenue instability trend is, in part, an artifact of the immediate upward

shock to revenue instability inherent in the equalization policy. If I do not separately capture the immediate policy shocks, but instead look at the overall change in trend 10 years before and 10 years after, I would see an artificial decline in revenue instability. Therefore, I use the 'during treatment' parameter included in equation (3) to control for the redistribution of funds associated with equalization, and separate that from the revenue response to a different tax base and state contribution level.

**Figure 2.4. View of Revenue Instability in States that Adopted Finance Equalization.**




Although a quadratic trend fits the data when time is treated continuously, when I divide the time periods into before, during and after, and a linear trend performs as well as a quadratic trend. Since I am interested in comparing the periods in the brackets shown

in Figure 2.4, a linear trend fits the data well for those periods. So I use that in my full specification.

*C. Interrupted Time Series Analysis of Treatment Effect*

To estimate equation (2), I use a cross-sectional time series random effects model with Generalized Least Squares estimation, with robust standard errors.[24] I do not have the usual concern about serial correlation of error terms when running a cross-sectional time-series model because my outcome variable of the fitted residual from a lagged growth model has already purged serial correlation. To allow for easier interpretation of the effect size, I standardize the residual, so that the point estimates can be read in terms of standard deviation units.

I run the model with a full set of state indicators to allow for interpretation of the effect across districts within each state.[25] Such a model allows me to control for unique structural or institutional features of each state. I also include a full set of year effects to account for trends across time within a state unrelated to the policy change, and to control for the fact that the set of years that comprise each state's pre- and post-policy trend varies based on the year of policy adoption. The percent of variance *between states* explained by these state- and year-effects models is 39 percent, compared to near 0 in specifications without state and year effects (available upon request), suggesting that unobserved state and year characteristics play a role.

First, I run the model without the time trend and interaction effect. I define the "during" policy period to be five years before the policy is adopted and three years after,

[24] Modified Wald tests indicate the presence of groupwise (between-district) heteroskedasticity, so I use robust standard errors.
[25] State indicators are included for 16 of the 17 states (due to the presence of the constant).

to account for how the anticipation of the policy change creates its own uncertainty and how the policy subjected districts to some expected uncertainty in the short-term. I use the before-reform period as the reference period. The first two columns in Table 2.3 include the post-reform and during-reform indicators in the model separately. On its own, the post-reform period ( more than 5 years after policy adoption) is negative and significantly different from the pre-reform period. The decline in instability of -0.216 standard deviation units is sizable. As expected, the point estimate for the during-reform period, or time of the policy shock, shows an increase in instability of 0.12 that is significantly different from the before-reform period. This result is the *expected* shock or increase in instability associated with policy implementation and intended reallocation of revenues across districts within a state.

I add the time trend and the interaction with each period separately, in columns 3 through 5. The inclusion of the time trend and the interaction of the reform periods with the time trend is jointly significant with the time period indicators (p-value of joint F-test =0.000). The point estimate for the post-reform period is negative and significant in each specification, and grows larger in absolute value as the time trend is included.

Results for the full specification for equation (2) are in column 5. In that column, the decline in instability in the post-reform period compared to the pre-reform period is -1.25, more than a full standard deviation. The interaction between the post period and the linear time trend is also negative at -0.01, but significant only at the 10 percent level. Notably, the policy shock, which was positive in specifications without the interaction with the time trend, is now negative and sizable at -0.56. The interaction between the policy shock and time trend is also negative and significant at -0.08. This suggests that

despite the expected instability associated with policy implementation, revenue instability declines over time even within the lead-up and implementation period. In short, both the instability level and the instability trend after reform decline. These results suggest that increased state responsibility for funding does reduce revenue instability in the states that adopted a change in the tax base and centralization of school funding.

[Table 2.3 here]

These estimates point to the marginal effect on instability in the post-reform period, controlling for the policy implementation period, but do not tell us the exact magnitude of the decline in instability within each state. To provide meaningful interpretation of the estimates in Table 2.4, I calculate predicted values for the change in instability for five states that adopted reforms in different years. I present these results in Table 2.4.

I find that regardless of the state or year of policy adoption, the predicted values for change in instability are all close to a full standard deviation decline. Oklahoma adopted its reform in 1987, so the comparison is between instability in 1992 and 1982. The predicted change is -1.03. Texas, which adopted its reform in 1989, has a decline of -1.38. To ensure the declines are not an artifact of the year or region of the country, I calculate predicted changes for two states, Missouri and Minnesota, that both adopted reforms in 1993 and are in the Midwest. Both have a decline in instability of approximately -1.2 standard deviations. Michigan, which had one of the more extreme changes in its tax base away from property taxes and toward sales taxes, has a decline in instability of -0.9 standard deviation units, slightly smaller than the other states. This may

suggest that the heavy use of property taxes in the before period had kept districts relatively stable, and the move toward more state contribution of funds also kept districts stable. In effect, there may not have been much opportunity for a larger decline in instability. Although the sales and income-tax base may have responded to business-cycle-related volatility during the 1980s and 1990s, it appears that in the post-equalization period, increased state responsibility for school funding insulated districts to some extent from that volatility regardless of the year of policy adoption.

[Table 2.4 here]

Finally, one might ask about including covariates or addressing moderating effects, e.g. *Does reliance on state revenue share exacerbate or ameliorate revenue instability in states that experienced school finance equalization?* I refrain from including state revenue share in the ITS model to test the interaction effect because a district's proportion of revenues from the state is a covariate that itself is affected by equalization. The covariate changes over time in a way that may be confounded with the treatment effect. If states are redistributing revenues among districts or losing revenues to their own volatile tax base, then the moderator of state revenue share would be defined by the treatment. As a result, inclusion would bias or confound the treatment effect.

## V. Discussion and Conclusion

A key contribution of this paper is initial evidence on the relationship between state responsibility for school district funding and instability. I hypothesized that high state responsibility would be associated with limited local autonomy and potentially more instability. I find that a district's reliance on state revenues is a significant predictor of revenue instability, and is associated with *increased stability*. When the state has responsibility for district funding, it may be able to cushion districts from unstable revenues.

The idea of the state as a buffer is borne out in the analysis of finance equalization. The findings from the policy analysis suggest that finance equalization did lower revenue instability across most states. There are several possible implications of this result. Equalization may cushion districts against revenue instability through more equal distribution of the revenues and therefore the attendant instability. The more equal distribution of revenues through centralization of finance may mean the state bears the primary burden of revenue instability, forcing the state to make cuts or adjust to shocks rather than having districts do so with more heterogeneous responses. In effect, state control of school revenues, either implicitly through high state revenue share districts, or explicitly through redistribution and equalization of funds, acts as social insurance for school districts.

Given states' current fiscal crises, policymakers may consider whether the current role of the state and the reliance on a sales and income tax base is a sensible long-term strategy. There is an inherent tradeoff between school funding systems. Systems based on sales and income taxes are susceptible to the business cycle, while property tax regimes

are subject to speculation, as seen in the recent housing bubble. The shift in the tax base or funding sources involved in school finance equalization may have substituted one type of fluctuation or uncertainty for another. If property taxes are acyclical, then they are insulated from macroeconomic shocks, but they expose some localities to more local shocks. This may explain some of the increase in revenue instability pre-equalization manifest in the graphs and model results. But given that sales and income taxes are cyclical, it is difficult to make state educational fiscal policy that counters that. The current recession demonstrates that it is difficult to predict how severe a business cycle downturn may be.

Even with decreased instability over time, districts still face revenue uncertainty. School finance policy still neglects the impact of instability on the marginal dollar districts have to spend. Given that teacher salaries and other large spending commitments may be fixed for a period of time, revenue uncertainty will affect discretionary spending more than fixed spending. Districts with more certain or stable revenues can identify and commit that marginal dollar to discretionary spending more easily than districts with uncertain revenues.

A final area to explore in future research is the responsiveness of spending to revenue instability and the efficiency (or inefficiency) of district resource allocation in the face of instability. If state centralization serves as a form of insurance but districts still face revenue instability, then the state is failing to fully insure its districts. In the following essay, I examine district spending responses in California, a state with high centralization but also high revenue instability.

**Table 2.1a. Proportion of total state tax collections made up by each source, 1970-2008.**

| Tax source | | Mean | Std. Dev. | Min | Max | Observations |
|---|---|---|---|---|---|---|
| **Income taxes** | overall | 0.345 | 0.177 | 0 | 0.799 | N = 403937 |
| | between | | 0.165 | 0 | 0.708 | n = 10359 |
| | within | | 0.064 | -0.004 | 0.593 | T-bar = 38.9938 |
| **Sales taxes** | overall | 0.517 | 0.137 | 0.023 | 0.874 | N = 403937 |
| | between | | 0.126 | 0.097 | 0.831 | n = 10359 |
| | within | | 0.054 | 0.315 | 0.771 | T-bar = 38.9938 |
| **Property taxes** | overall | 0.016 | 0.030 | 0 | 0.530 | N = 403937 |
| | between | | 0.025 | 0 | 0.139 | n = 10359 |
| | within | | 0.017 | -0.062 | 0.469 | T-bar = 38.9938 |
| **Other taxes** | overall | 0.122 | 0.079 | 0.028 | 0.841 | N = 403937 |
| | between | | 0.071 | 0.044 | 0.550 | n = 10359 |
| | within | | 0.033 | -0.361 | 0.418 | T-bar = 38.9938 |

**Table 2.1b. Income and Sales Taxes are More Unstable, on Average, than Property Taxes.**

**Instability measured as Standard Deviation of the Residual from Lagged Growth Model**

| Tax source | Mean | Std. Dev. | Min | Max | District Obs |
|---|---|---|---|---|---|
| **Income taxes** | 0.015 | 0.009 | 0 | 0.110 | 10359 |
| **Sales taxes** | 0.016 | 0.006 | 0.007 | 0.053 | 10359 |
| **Property taxes** | 0.003 | 0.005 | 0 | 0.049 | 10359 |

**Table 2.2a. Relationship between instability and sales tax base not significant, but shows decline.**

| | **Dependent Variable: Standard deviation of the residual from a lagged growth model of state revenues, averaged by decade for each district.** | | |
|---|---|---|---|
| | Decade fixed effect | Decade & district fixed effects | Decade & state fixed effects |
| **Percentage of Total Tax Collections from Sales Tax, Averaged by Decade for Each District:** | 0.0316 | -0.00812 | -0.0468 |
| | (0.0611) | (0.186) | (0.224) |
| Constant | 0.137 | 0.184 | 0.205 |
| | (0.0340)*** | (0.106) | (0.127) |
| R-sq | 0.028 | 0.152 | 0.443 |
| Number of observations | 33228 | 33228 | 33228 |
| Number of districts | 10224 | 10224 | 10224 |
| Robust standard errors in parentheses, clustered at the state-by-decade level | | | |
| +: p<0.1* p<0.05, ** p<0.01, *** p<0.001 | | | |

**Table 2.2b. Relationship between instability and income tax base not significant, but shows increase.**

| | **Dependent Variable: Standard deviation of the residual from a lagged growth model of state revenues, averaged by decade for each district.** | | |
|---|---|---|---|
| | Decade fixed effect | Decade & district fixed effects | Decade & state fixed effects |
| **Percentage of Total Tax Collections from Income Tax, Averaged by Decade for Each District:** | -0.0435 | 0.0391 | 0.0794 |
| | (0.0423) | (0.213) | (0.254) |
| Constant | 0.169 | 0.168 | 0.157 |
| | (0.0157)*** | (0.0603)** | (0.0720)* |
| R-sq | 0.030 | 0.152 | 0.443 |
| Number of observations | 33228 | 33228 | 33228 |
| Number of districts | 10224 | 10224 | 10224 |
| Robust standard errors in parentheses, clustered at the state-by-decade level | | | |
| +: p<0.1* p<0.05, ** p<0.01, *** p<0.001 | | | |

**Table 2.3. Average Revenue Instability Declines After Finance Equalization, Controlling for the Policy Shock (defined as 5 years before and 5 years after).**

Sample restricted to districts in states that equalized.

| **Dependent Variable: Standardized Residual from Lagged Growth Model of Log PP State Revenues** | | | | | |
|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 |
| Post (>5 years after) | -0.216*** | | -0.205*** | -0.644*** | -1.253*** |
| | [0.012] | | [0.021] | [0.038] | [0.048] |
| Policy shock (5 years before and 5 years after) | | 0.122*** | 0.009 | 0.043*** | -0.555*** |
| | | [0.007] | [0.011] | [0.012] | [0.033] |
| Linear Time Trend | | | -0.003 | -0.014*** | 0.057*** |
| | | | [0.002] | [0.002] | [0.004] |
| Post*Linear Time Trend | | | | 0.067*** | -0.011+ |
| | | | | [0.005] | [0.006] |
| Policy Shock *Linear Time Trend | | | | | -0.084*** |
| | | | | | [0.005] |
| Constant | -0.237*** | -0.156*** | -0.286*** | -0.412*** | 0.268*** |
| | [0.045] | [0.044] | [0.026] | [0.029] | [0.044] |
| State Fixed Effects | Y | Y | Y | Y | Y |
| Year Fixed Effects | Y | Y | Y | Y | Y |
| Number of Cases | 72373 | 72373 | 72373 | 72373 | 72373 |
| Number of Districts | 4369 | 4369 | 4369 | 4369 | 4369 |
| R-Squared within | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 |
| R-Squared between | 0.39 | 0.39 | 0.39 | 0.38 | 0.39 |
| p-value of joint F-test | | | 0.169 | 0 | 0 |

**Table 2.4. Predicted Changes in Average Instability for States that Equalized in Different Years Shows that Instability Declines by 1 standard deviation.**

| State | Year Adopted | First "post" year | Predicted change in instability compared to 'pre-policy' period |
|---|---|---|---|
| Oklahoma | 1987 | 1992 | -1.034 |
| Texas | 1989 | 1994 | -1.38 |
| Missouri | 1993 | 1998 | -1.218 |
| Minnesota | 1993 | 1998 | -1.174 |
| Michigan | 1994 | 1999 | -0.901 |

## Table A2.1. Dates of state school finance equalization reforms.

| State | Legislative Reform | Court-Ordered Reform | Major changes in foundation tax rate and use of sales/income tax to fund education during reform era |
|---|---|---|---|
| Alabama | | 1993 | |
| Arizona | 1980 | 1994 | X |
| Arkansas | | 1983 | |
| California | 1971, 1977 | 1978 | X |
| Colorado | 1973 | | |
| Connecticut | | 1978 | X |
| Florida | 1973 | | |
| Georgia | 1986 | | |
| Idaho | 1978 | | |
| Indiana | | | X |
| Iowa | 1972 | | |
| Kentucky | | 1989 | |
| Louisiana | 1988 | | |
| Maine | 1978 | | |
| Maryland | 1987 | | |
| Massachusetts | 1985 | 1993 | X |
| Michigan | 1994 | | X |
| Minnesota | 1973 | 1993 | |
| Missouri | 1977 | 1993 | |
| Montana | | 1989 | X |
| New Hampshire | 1985 | 1993 | |
| New Jersey | | 1973, 1976, 1989, 1991, 1995 | X |
| New Mexico | 1974 | | |
| New York | | | X |
| N. Carolina | | | X |
| Oklahoma | 1987 | | |
| Pennsylvania | | | X |
| Rhode Island | 1985 | 1994 | |
| S. Dakota | 1986 | | |
| Tennessee | 1977 | | |
| Texas | 1984 | 1989 | X |
| Vermont | 1987 | | |
| Virginia | 1975 | | X |
| Washington | | 1978, 1991 | |
| W. Virginia | | 1979, 1988 | |

*Sources:* State categorizations based on Murray, Evans & Schwab (1998); Hoxby (2001); and Card & Payne (2002). Categorizations for 2008 from Hightower et al. (2010).
NB: I exclude Ohio, Illinois and Utah since their reforms occurred over several years and do not lend themselves to analysis of change at a discrete time point. I exclude Hawaii since the state is a single district.

**Table A2.2. Summary Statistics for Demographic Variables in Sample States that Equalized in the 1980s and 1990s.**

| Variable | Mean | Std. Dev. | Min | Max |
|---|---|---|---|---|
| | | | | |
| Enrollment | 3438 | 8052 | 114 | 205431 |
| Proportion Special Education Students | 0.125 | 0.033 | 0.034 | 0.482 |
| Proportion Black Students | 0.081 | 0.160 | 0.000 | 0.999 |
| Proportion FRL Students | 0.305 | 0.169 | 0.000 | 0.916 |
| | | | | |
| Proportion total revenues from the state | 0.523 | 0.171 | 0.039 | 0.844 |
| district is in metro area | 0.058 | 0.234 | 0 | 1 |
| district is in rural area | 0.555 | 0.497 | 0 | 1 |
| district is in suburban area | 0.191 | 0.393 | 0 | 1 |
| district is in Western U.S. | 0.074 | 0.262 | 0 | 1 |
| district is a county | 0.097 | 0.296 | 0 | 1 |

# School District Responses to Revenue Instability: Evidence from California

## I. Introduction and Purpose

The recent decade in California presents a critical case for examining spending responses to revenue instability. The boom and bust cycle of California's state revenues since 2000 has created a chronic condition of unpredictability for districts. In the past decade, the state budget has either under- or over-estimated tax revenue collections, adopted budgets after the fiscal year for which it was designed, and delayed full disbursement of funds to districts. California is not alone in these measures, though. An increasing number of states have adopted budgets well after the start of the new fiscal year—and even still have made additional funding cuts to education *after* enacting the state budget.[26] California cut revenues to K-12 districts through multiple avenues: across-the-board cuts in per-pupil revenues as well as changes to particular categorical grant programs. In addition to this uncertainty, districts face property tax caps and other limitations on raising local revenues. However, faced with the same state-level conditions and a relatively centralized school finance system, not all districts in California adopted the same spending responses. This descriptive paper seeks to describe that variation along several dimensions. The primary research questions this paper asks are:

- What approaches do California districts adopt to cope with state budget cuts?
- How have these approaches varied across time, as state revenues have declined?
- How do spending responses vary by district management characteristics?
- How do spending responses vary by district's fiscal health?

[26] National Conference of State Legislatures, 2010 Budget report. For example, Governors in Kansas, Kentucky, Michigan, Mississippi and New York proposed cuts to the FY2010 education budget post-enactment.

This paper is part of a broader project that defines instability, examines potential causes of instability, and in turn assesses the possible effects of, and school district responses to, instability. This paper addresses the latter point, using survey data from a sample of California school districts about their responses to instability, supplemented by administrative and historical fiscal data to assess the magnitude of instability each district experienced prior to completing our survey. The survey of school district budget officers was conducted in 2006 and 2010, with questions added in 2010 regarding current budget challenges. By following up with respondents to the first survey, I can measure changes in perceptions and budget practices *within* a district over time, as well as compare changes *between* different types of districts. Although the two surveys do not correspond to a pre-test and post-test of a discrete policy change, they represent a kind of peak and trough of state aid to districts within the past decade. The 2010 survey was administered at the end of the 2009-2010 year and asked about enacted or proposed district changes in allocations for the 2010-2011 year. My survey and analysis differ from other recent surveys in several key ways. The California Department of Education tabulated total costs cut in 2010. The California Legislative Analyst's Office district survey in 2010 and 2011 explored responses specifically to the categorical flexibility introduced in 2009-10, but does not have a pre-fiscal crisis time point for comparison. In addition, neither of these surveys released results that describe variation by district characteristics or by district fiscal management to spending responses. And neither examined how past history of revenue instability relates to current cost-cutting efforts.

Based on evidence from Essays 1 and 2, I focus on several factors that may explain variation in budget cuts that districts adopt. These predictors include district size

(students enrolled) and proportion of students eligible for Free and Reduced Price Lunch, which Essay 1 showed to be associated with revenue instability. To test if revenue instability itself is linked to specific spending choices, I include a measure of revenue instability that summarizes the degree of instability the district experienced from 2000-2008. Finally, I am able to take advantage of data on the experience of the district budget officer to control for a management factor that is often unobserved in national data.

I examine several outcomes that reflect district response to revenue cuts. First, I consider whether the district is adopting a severe budget cut (6 percent or more). Second, I consider cuts in instructional expenditures specifically. I use instructional expenditures to gauge to what extent revenue shocks and instability affect core programs and school functions. Third, I examine changes within instructional spending categories, such as cuts to teaching staff. Fourth, I examine cash reserve fund levels for California districts as an outcome that reflects a district's fiscal health. Finally, I examine whether a district is raising local revenues in response to state budget cuts.

I find that budget officers do perceive the fiscal climate to be worse in 2010 than in 2006, and pursued more severe spending cuts for the 2010-2011 fiscal year than they did in the past. First, districts with unstable state revenues are more likely to cite predictable state funding as the most important feature for planning their budgets. In response to fiscal stress, local government agencies typically will seek to raise revenues, cut staff or programs to reduce costs, or enhance efficiency and productivity of existing resources through contracts or job-sharing. Sample districts cited more cost-cutting measures than local revenue-raising or efficiency-related practices. Most important, cost-

cutting did not spare instructional staff and programs, suggesting that districts are so revenue-constrained that they are not protecting instructional spending.

In a sign of the importance of management, experienced budget officers are more likely to maintain high cash reserve levels. Yet experienced officers are also more likely to pursue cuts across staff and program categories, compared to less experienced officers. These results may reflect that experienced officers take relatively cautious approaches to spending. Since experienced budget officers work in districts with characteristics similar to their less experienced counterparts, one does not worry that experience is confounded with other characteristics of the district. Some of the results do raise potential equity concerns. Districts with a high proportion of students who are racial minorities adopted more severe budget cuts (six percent or more of their general fund spending) than other districts. These findings suggest that districts across California are suffering from shrinking resources, and that districts with more vulnerable student populations are coping with the loss of resources by cutting staff and programs for the children who may need them most.

This paper contributes to our understanding of the relationship between revenue fluctuations and school district spending, in particular variation in short-term adjustments that districts pursue. In addition, because the fiscal crisis in California is not over, the results provide a snapshot of short-term district responses.

The rest of the paper is organized as follows: Section II reviews policy and funding changes in California in the past decade to set the policy context underlying spending responses for the 2010-2011 fiscal year. I also summarize the sparse literature on district spending responses to state fiscal stress. Section III discusses the survey and

administrative data I use, and the methods of analysis. Section IV reports the results for six different outcomes. Section V concludes with some policy implications for California.

## II. Policy Background and Motivation

The research questions discussed in the introduction are motivated by literature on the sources of fiscal stress for school districts and literature on local government responses to fiscal stress. In addition, a series of funding shocks and attendant finance policy changes in California motivate this study.

Few studies exist about how local governments respond to fiscal stress, and of those, few focus on the school district as the unit of analysis. Early papers in this area focused on district responses to tax and expenditure limitations. In effect, centralization has dampened local efforts that would otherwise allow districts flexibility to cope with instability. Districts with local revenue-raising authority have more options for countering state revenue instability and smoothing their total revenues. But centralization through finance equalization has limited the extent to which some districts can raise local revenues, by capping property tax rate increases or requiring supermajorities to pass parcel taxes. Mullins (2004) evaluates revenue disparity across school districts in different states enacting tax and expenditure limitations in different years. He finds that tax and expenditure limitations increase revenue variation (a 19 percent net increase) if they limit lower-spending or resource-constrained districts more.[27] This suggests that resource-constrained districts tend to have more revenue variation than less-constrained

[27] He uses an interrupted time-series design with a nonequivalent comparison group of states that did not enact limitations.

districts. In addition, Downes & Figlio (1999) find that spending declines after limits are adopted.

Much of the literature on school district spending does not identify in which categories spending changed. In a study of school district responses to revenue reductions due to property tax caps in the Chicago area, Dye & McGuire (1997) find that districts reduce or limit overall operating expenditures. They find evidence of substitution, in that instructional spending stays relatively constant while non-instructional spending declines. However, preserving instructional spending does not necessarily mean preserving instructional quality. Some districts increase class sizes or pupil-to-teacher ratios under fiscal duress (Berne and Stiefel 1993; Monk et al. 1997; Nguyen-Hoang 2010).

Stipak and O'Toole (1993) note that when revenues contract, districts seek cost-cutting or other ways to generate slack 'resources,' yet this is precisely when it is difficult for districts to do so. Williams (2011) is one of the rare studies assessing school district responses to fiscal stress. He identifies how districts in New York used resource slack—either in the form of reserve funds or unused revenues from the state— to smooth spending after the 2001 recession. He focuses on slack that is recoverable, such as spending below forecasts or other unused resources. To this end, Williams finds that districts with low reported fiscal stress report ample slack resources, while districts with high fiscal stress report no slack resources. Notably, districts with higher local revenues per pupil are more likely to report ample slack resources than districts with no slack resources did. This result may suggest that local revenues offer more opportunity for resource flexibility and slackness than state revenues alone do.

Williams also distinguishes between cost-cutting, revenue-increasing, and efficiency-enhancing practices, based on a survey of school district budget managers. He finds that two-thirds of districts cited efficiency-enhancing practices, such as joint purchasing agreements, job-sharing and contracting out services. I ask about practices in all three areas in my survey, but do not find efficiency-enhancing practices to be preferred responses among my sample respondents.

Two key gaps in the literature stand out. First, we do not understand how responses to revenue uncertainty vary by district characteristics. Recent surveys[28] provide an overall picture of cuts districts are pursuing, but do not explain variation in those responses by district characteristics. Second, we do not understand how district responsiveness to fiscal stress varies over time. Academic studies of school district responses tend to focus on particular episodes of fiscal stress, such as the post-2001 revenue declines (Dye and Reschovsky, 2008; Alm and Sjoquist, 2009; Alm, Buschman, and Sjoquist, 2009; Boyd, Lankford, and Wyckoff, 2002). Though useful, such studies do not discuss whether more revenue-unstable districts are more or less likely to pursue certain responses.

***Institutional mechanisms that might explain variation:*** Several institutional challenges may exacerbate variation in responses to instability between school districts. First, there may be a mismatch in the capacities of and expectations placed on school districts. Districts are not explicitly in the business of financial management, though California is one of many states that require budget officers to have minimum levels of

[28] For examples, see California Department of Education (2010), California Legislative Analyst Office (2009 & 2010), Association of School Business Officials (2009).

training and financial planning in order for districts to avoid fiscal crisis.[29] There may be differences in district responses based on the budget officer's experience. Despite a set of "Criteria and Standards" for school budgets established by the California Department of Education outlining the range of allowable changes for districts of various size and fiscal health, recent state fiscal shocks have made adhering to these requirements extremely difficult.

Second, the budget institutions in one district may not exist in another. Something as simple as the number of past years a districts uses to forecast next year's revenues may change relative to a superintendent's tenure or be institutionalized in budgeting software used regularly. Third, savings schemes, such as reserve funds, may insure districts against state-level shocks, but not all districts have such institutions available to them. Fourth, the sheer size and/or demographic composition of a district may influence their ability to substitute spending from one category to another as a way of smoothing instructional spending. I examine to what extent mechanisms such as savings funds and district size and composition are related to spending responses.

***Recent funding and policy changes in California:*** Beginning in 2001, a series of economic shocks or miscalculations of revenues instigated a cascade of state-revenue shocks for school districts. In 2001-2002, the collapse of technology stocks contributed to an 18 percent decline in state general fund tax revenues per capita. In response to this fiscal crisis, the state adopted several unprecedented measures that have since been repeated. First, it made a mid-year cut in the budget, introducing a level of revenue uncertainty that districts had previously not experienced. Second, the state deferred

[29] For example, California's Fiscal Crisis and Assistance Management Team requires certain financial planning measures as part of their district certification process.

appropriations originally intended for 2001-2002 to the 2002-2003 fiscal year. Unfortunately, the state budget for 2002-2003 assumed the state tax base would recover, but the projections overestimated state revenues. Therefore, once again, the state enacted mid-year budget cuts and deferrals. In 2003-2004, the state cut revenues to K-12 districts in the form of reductions in categorical funds, cost-of-living allowances (COLAs), and, most important, the per-pupil revenue limit (the unrestricted revenues that are a function of prior year revenues and inflation adjustments, multiplied by the district's average daily attendance). For 2004-2005, the state *under*-estimated tax revenues and therefore suspended requirements related to a minimum guarantee of funds to districts. As a result, even though the tax base did recover that year, the state had no requirement to distribute those funds, effectively leaving tax revenues on the table that they could have disbursed to districts.

For 2005-2006—the year in which the first survey wave was conducted—the increase in the state tax base was realized and passed on to districts. The tax base continued to grow for 2006-2007, which allowed the state to restore somewhat the funding that had previously been cut. As a result, the survey results for the first wave of data may reflect a more positive outlook than budget officers may have had in preceding or subsequent years. Unfortunately, the increases between fiscal years 2006-2007 and 2007-2008 were not sufficient to restore fully the cost-of-living adjustments to their relevant levels for that year. In addition, the state had forecast revenues to decline again, so the minimum funding guarantee was again reduced. When the broader economic and housing market collapse set in, and projected revenues fell far short of expectations, the state declare a "fiscal emergency" in the middle of the fiscal year. There was a two-year

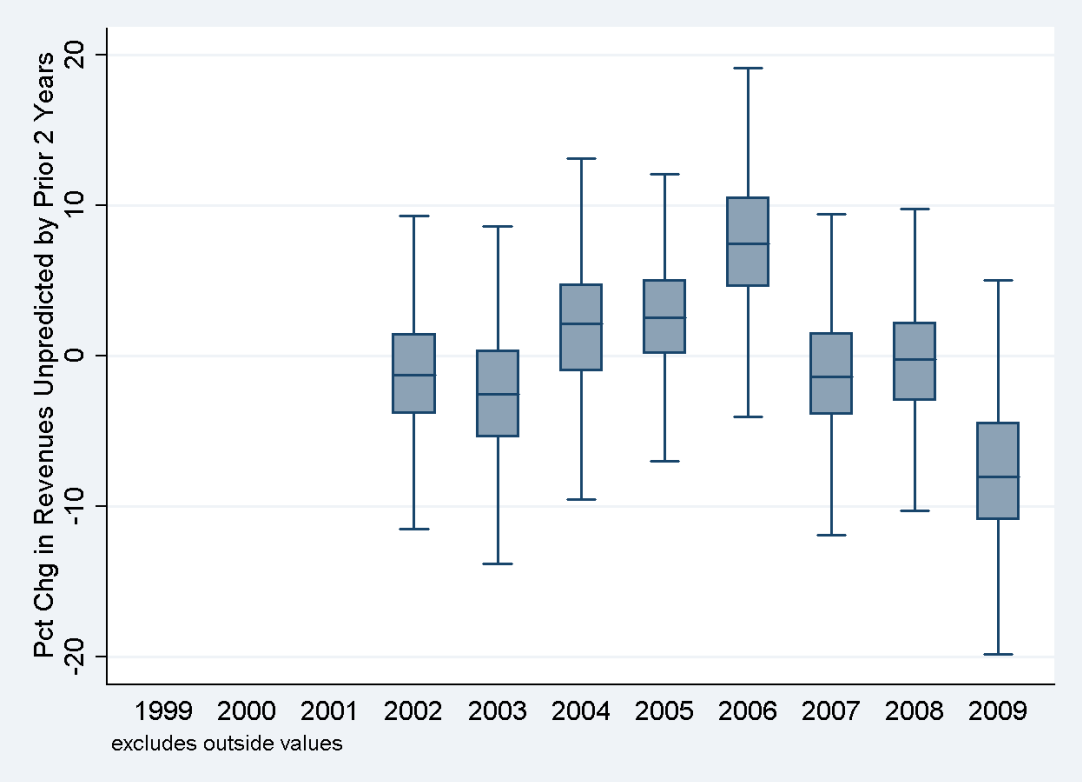
budget shortfall of $40 billion. By the 2008-2009 fiscal year, tax revenues were declining so severely that it was difficult to assemble a budget, and politically the legislature could not agree on which areas to cut. Budget adoption was delayed by almost three months into the fiscal year, and the late budget was followed by another mid-year cut. For the 2009-2010 year, revenue collections continued to be worse than expected. As a result, the state again cut the minimum guarantee funding, eliminated the cost-of-living adjustment for that year, and deferred disbursal of funds. In addition, roughly $1.6 billion in categorical funds were cut (a 19.8 percent cut from 2007-2008 levels) and the revenue limit cut was approximately $252 per student. All told, these cuts amounted to an 18.35 percent deficit on the revenue limit.

Before 2008-2009, the state funded 60 K-12 categorical programs. For the 2009-2010 year through the 2012-2013 fiscal years, the legislature enacted the so-called Ed-Flex program, which removed constraints pertaining to roughly 40 categorical funding areas and allowed districts to use formerly restricted funds as unrestricted, flexible funds. These included provisions to allow districts to shorten the school year, provide supplemental instruction to students needing assistance to pass the California high school exit exam, and funds for arts, music, physical education and gifted and talented education programs.

The series of cuts outlined above resulted in fluctuations in the minimum funding guarantee, which approximates about half of the change in state revenues, according to School Services of California. This means that funding not only declined but was also uncertain during the past decade. In short, districts faced low average funding and high variability in funding – a perilous combination for planning. Figure 1 plots this

variability. Rather than display mere differences, I plot the unpredictable change in (inflation-adjusted) revenues per average daily attendance (ADA) from 2002 to 2008 . The horizontal lines in each box represent the mean district value and the brackets mark where districts with revenue unpredictability at the 25$^{th}$ and 75$^{th}$ percentile values are. The graph illustrates that revenues fell more than districts expected in 2002-2003, then increased far more than expected in 2006 due to the tax base increase. On average, revenue was almost perfectly predictable for districts in 2008, but decline in the tax base in 2008-09 led to an unpredicted revenue decline of 10 percent in 2009-10. It is interesting to note that the unpredictability in 2005 is more tightly clustered around 0, while in other years the unpredictability across districts is more widely dispersed.

**Figure 3.1. Districts experience variation in revenue unpredictability over time.**



## III. Data and Methods

In this section, I discuss the measures of fiscal health I construct, survey sampling and design, and the administrative data I use. I then discuss the descriptive methods of analysis I use.

*3.1 Administrative and fiscal data:* I use district-level administrative data from the California Department of Education (CDE) from 1999-2000 to the 2009-2010 academic years in order to predict the 2009-2010 responses. This data includes student composition indicators, such as average class size, percent of students who are English-learners, racial minorities, or eligible for Free and Reduced-Price Lunch. It also provides average levels of teacher salary and teacher experience, such as percent of teachers with less than two years experience and percent who are fully credentialed. The CDE data also provide indicators of expenditures and revenues per pupil. When I attempt to construct a measure of revenue uncertainty facing districts over the past decade, I rely on the CDE per-pupil revenue data. For detail on changes in revenues and expenditure between the 2008-09 and 2009-10 fiscal years, I rely on the Standardized Account Code Structure data.[30] I obtain data on cash reserve levels as of 2009 and indicators of which districts are basic aid districts as of 2011 through the School Fiscal Services division of the CDE.

*3.2 Measure of instability:* Given the presence of revenue fluctuations in California, I want to capture the extent to which districts face uncertainty in the revenues they receive. I define revenue instability as the unpredictable component of year-to-year revenue change. Essay 1 describes this method in more detail, and I provide a quick

[30] However, the budget codes used in the SACS have not always aligned with the general CDE revenue and expenditure totals in prior years. When CDE revenue and expenditure totals become available, I will use those for more comparability across years.

summary here: I estimate the unpredictable component as the residual from a lagged growth model of state revenues.[31] Budget officers who participated in interviews said they generally consider two to three prior years' of changes in order to forecast or estimate changes in revenues for the upcoming fiscal year. I then standardize this measure so that one can interpret relationships to instability in terms of standardized effects. For California, I calculate the instability measure based on the change in the log per-pupil state revenues that a district received in each year from 1999-2008. (This time period includes the 2001 technology company collapse in which California lost significant state revenues, as well as the uptick in state revenues from 2005-2007). Based on the year-to-year instability measure for each district, I calculate the district's average over time. Then I rank districts according to their average instability, and create an indicator for whether a district is above or below the sample mean for unpredictability in their state revenues.

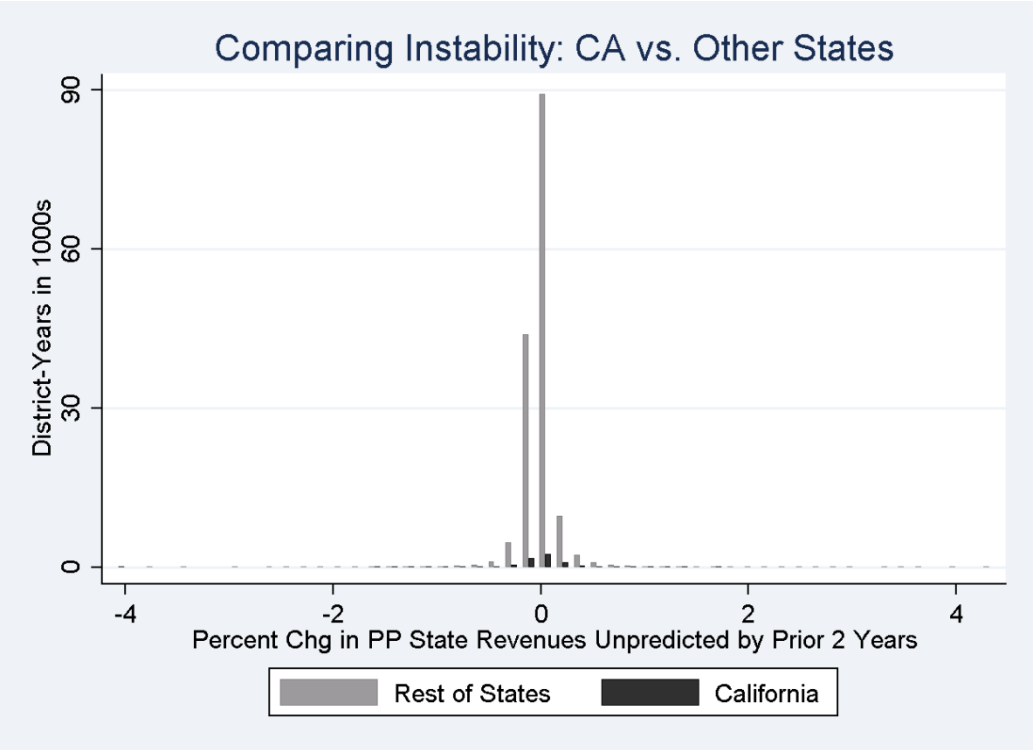
To gauge generalizability of results from California, I compare instability in state revenues between California and the rest of the country.[32] Figure 3.2 compares the histograms of revenue unpredictability for districts in California to those in other states. California districts are not the most extreme in the country. At the extreme right and left tails of the distribution, when the revenue instability measure exceeds 3 and -3 respectively, districts elsewhere in the country have more years of unpredictable state revenues. From 1990-2008, California districts have a distribution of unpredicted

[31] $\Delta ln(Revenues)_{t-(t-1)} = \beta_{1d}\Delta ln(Revenues)_{(t-1)-(t-2)} + \beta_{2d}\Delta ln(Revenues)_{(t-2)-(t-3)+} u_t$

[32] National data come from the National Center for Education Statistics Common Core of Data. I exclude Vermont, Delaware, Montana, Hawaii and District of Columbia from the non-California sample, since those states have little or no within-state variation.

changes that is comparable with the majority of districts in the rest of the country. Although the political climate and decision-making creates the specter of extreme uncertainty, the actual unpredicted percent change in revenues turns out to be in line with what districts in other states experience, on average.

**Figure 3.2. California districts have revenue-unstable years comparable to the rest of the country from 1990-2008.**



*3.3 Survey*

*3.3a Survey sampling:* The California survey builds on the sampling strategy of a school district survey conducted in 2006.[33] In simple random sampling in California, small districts are typically over-represented because there are more small districts than large districts in California (17 percent of districts in the sample have fewer than 1,000 students enrolled, while 41 percent of districts in the state have fewer than 1,000 students). The 2006 survey team had stratified the state's 978 non-charter school districts by size (measured by student enrollment), across six enrollment strata. The first enrollment stratum has an enrollment range between 0 to 1000 students, while the last enrollment stratum includes districts with more than 30,000 students. This random stratified sample was intended to sample an equal number of districts in each strata (EdSource, 2006).

In addition to the random sampling within enrollment strata, the 2006 team sampled purposively according to district finance conditions. The survey team had used administrative fiscal data to calculate districts that might be at risk of financial distress due to high debt loads or low reserve levels. The team oversampled districts that the state had assessed as financially unhealthy. The other district type of interest in the purposive sample is the so-called Basic Aid district: those districts that collect more in local property taxes than they would receive from the state 'revenue limit' or minimum guarantee of funds. Such districts argue their revenues are less certain and thus they have less of a safety net than districts reliant on state revenues. They tend to maintain higher

[33] In that year, the Governor's Committee on Education Excellence in California requested the "Getting Down to Facts" project, led by Susanna Loeb at Stanford University, to examine resource allocation in the state. One component of this project was a survey of school district business officials, administered jointly with EdSource and School Services of California.

cash reserve fund levels than other districts, and therefore might have a different risk profile than districts that rely solely on state revenues. According to the annual report of the state's Fiscal Crisis and Management Assistance Team, certifications are based on the ability of the district to meet its financial obligations for the current and two subsequent fiscal years. "Positive" means the district meets those obligations; "qualified" means the district may not meet its obligations; and "negative" indicates the district is unable to meet obligations for the remainder of the current year or for the upcoming year. FCMAT evaluates districts on 11 performance areas that predict the need for financial intervention. [34] Tables 3.1a and 3.1b show the distribution of district size and financial health in the sample stratification in 2006 and 2010. Table 3.1c shows the number of districts in each stratum for each year. I review the advantages and disadvantages of weighting the tabulations and regressions up to the population in Appendix A3.1. For this paper, I present unweighted results due to limitations of weighting discussed in the Appendix.

[Tables 3.1a-3.1c here]

Out of 198 paper surveys mailed in 2006 (a 20 percent sample of the target group), 135 responded and remained in the sample (a 68 percent submission rate). The response rate was high in part because the survey was distributed by School Services of California, the primary quasi-governmental agency that assists school districts with their financial planning. I followed up with these 135 districts in the 2010 survey. I provided a modest gift card for those who began the survey; 72 completed the 2010 web-based

[34] http://wwwstatic.kern.org/gems/fcmat/predictors12805.pdf

questionnaire (12 additional districts had begun the survey, but did not finish).[35] To determine the analytic sample for comparison across both survey years, I match completed surveys from both years by district identifier (not by budget officer, since officers changed in many districts). I end up with a sample of 68 districts, or 50 percent of the 2006 respondents. Although this sample size is not ideal for multivariate analysis, the response rate is not trivial given the intense time pressures facing budget officers in California this past year. Budget officers are so-called elite respondents (Becker & Meyers 1974), who typically have low survey response rates but hold knowledge or decision-making authority that few others have.

*3.3b Survey sample comparisons and summary statistics:* There are two concerns about the representativeness of the survey sample. First, one may worry about attrition bias—if districts that stayed in the sample differ systematically from those that responded in 2006 but did not respond in 2010. I use t-tests as well as adjusted Wald tests from a bivariate time-series regression to test if districts that attrited from the sample are significantly different from those that remained. I present results of the t-tests in Table 3.2a. Results show no significant differences on observable demographic or fiscal characteristics.

[Table 3.2a here]

Second, one may worry that the respondents who remain in the sample are significantly different from the rest of the state. I compare those who are in the sample in

[35] The survey was distributed using Qualtrics web survey software (qualtrics.com). Unique survey links were distributed to emails for budget officers. I obtained and/or verified emails through phone calls to the district. I sent follow-up emails using the software, and followed up with phone calls to the district office.

2010 to two groups: districts that were never sampled, and all districts in the state in 2010. Table 3.2b presents the summary statistics and comparisons for never-sampled versus ever-sampled districts based on 2009-2010 data. Districts that were never sampled differ from the sampled districts primarily on those characteristics related to student enrollment. Enrollment and pupils per teacher are lower in the never-sampled districts than the sampled ones (at $p<.05$). Revenues and expenditures per average student attendance are about $1,000 higher (in inflation adjusted 2008 dollars) in the never-sampled districts. These differences are not surprising given the stratification based on enrollment. The notable difference is that Average Teacher Salary is about $3,900 lower in the never-sampled districts than the sampled ones, however more than 16 percent of districts did not report salary data in 2009-10. Based on these results, it is difficult to conclude whether the 2010 sample is biased on unobservables relative to other districts in the state. I am inclined to believe that the sampled districts are representative within their enrollment strata, but that heterogeneity across strata exists. Two variables, Average Teacher Salary and Percent English Learners, have more than 10 percent of never-sampled districts with missing data. Both of those variables are difficult to impute without more information about the district staff and student composition.

Table 3.2c presents demographic and staffing characteristics for districts that are in the survey sample in 2006 and 2010, and compares those to all K-12 districts in California that are non-charter, non-special education and non-vocational. Mean enrollment—as expected given the over-sampling of large districts due to stratification—is 21,831 students, compared to an average of 6,381 students statewide. Average teacher salary is higher in the sample: $66,989 versus $63,350. Several variables are comparable

between the sample and the state: pupils per teacher (21.3 vs. 20.1 in the state), the percent of fully credentialed teachers (96 percent in both cases) and the percent of teachers with less than two years' experience (2.4 vs. 2.6 in the state). The percent English learners is slightly higher in the sample (19.9 vs. 18.7), while the percent of students eligible for free and reduced-price meals is lower in the sample (49.3 vs. 52.2). Revenues per average daily attendance are significantly lower in the survey sample than in the rest of the state ($9,687 versus $11,267), as are expenditures per average daily attendance ($8,959 vs. $10,178). In regression results in section 4, I convert salaries, revenues and expenditures to thousands of dollars so that the coefficients are easier to interpret.

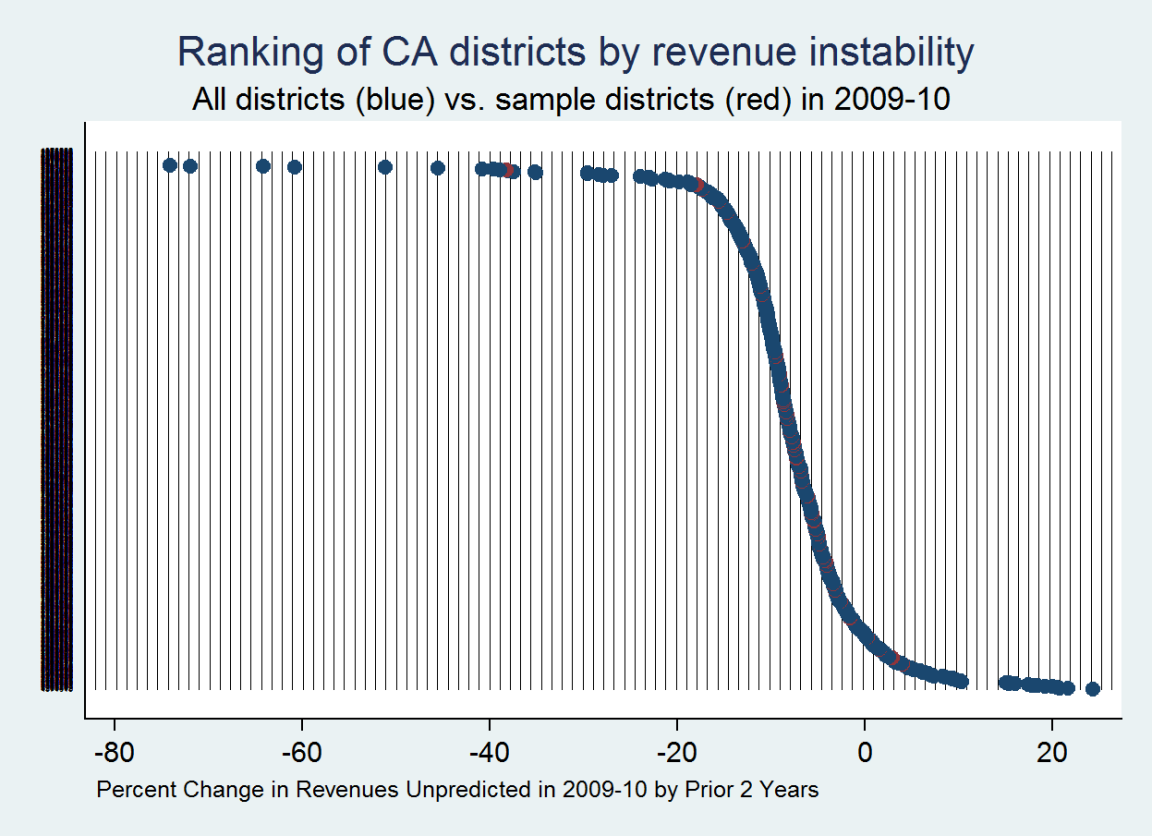
[ Tables 3.2b & 3.2c here]

Table 3.3 compares districts on fiscal characteristics. I draw more detailed spending data from the California Standardized Account Code Structure, to verify if per-pupil spending is indeed lower in sample districts than in the state as a whole. In terms of per-pupil expenditure levels, operating, instructional and support expenditures are all significantly lower in the sample. Because I want to examine spending responses among those who faced revenue instability, I need to determine whether the responses I observe are a lower- or upper-bound estimate. When comparing the districts that remain in the sample from 2006 to 2010, the respondents who remained in the sample are *more* revenue-unstable than those that left. However, when comparing the 2010 survey sample (n=68) to all districts in the state in 2010 (n=957), sample districts are *less* revenue-unstable on average.

[Table 3.3 here]

But when I rank all districts in the state according to revenue instability in revenues per ADA, my sample districts appear evenly distributed throughout the ranking, as shown in Figure 3.3. It appears that revenue instability for the whole state is higher, on average, due to the influence of the outlier districts with unpredicted revenue declines in 2009-10 of more than 40 percent.

**Figure 3.3. Sample districts have distribution of revenue instability comparable to the rest of the state.**




On several dimensions, it appears that the sample represents the state of California. Survey sample districts serve similar student populations as the rest of the state. Although sample districts have lower revenues and expenditures per pupil than the rest of the state, their teacher composition and salary levels suggest they must meet similar teacher salary obligations as what other districts in the state face. Since

instructional and salary expenditures make up more than 85 percent of most districts' spending, it appears that the sample is representative in terms of spending obligations they face, which is the primary concern of this paper.

*3.3c Survey content:* The 2006 survey was a comprehensive, hour-long paper survey covering nine key topics: business/budget officer qualifications and responsibilities, governance and administration, cost controls and budgeting practices, retiree health benefits, collective bargaining, operations management, efforts to maximize revenues, resource allocation strategies, and general perceptions. Many of these questions were asked as agree-or-disagree questions on a four-point scale. The questions asked about changes districts were considering for the 2006-07 fiscal year.

The 2010 questionnaire continued some items from the 2006 survey: questions about budget officer qualifications and self-assessment of skills, teacher contract provisions, efforts to maximize local and private revenues, and perceptions of key factors for effective financial management. I added specific items pertinent to planning for the 2010-11 budget year, such as use of federal stimulus funds (American Recovery and Reinvestment Act), and the impact of state budget cuts on budget planning practices, cost-cutting measures, and teacher hiring and layoffs. I developed these items through an iterative process of focus groups, interviews and pilot testing of key themes and questions.[36] The instrument is included in Appendix A3.2. The 2010 survey was a 15-

[36] To develop the questionnaire items for 2010, I consulted a variety of sources. First, I reviewed professional standards issued by the international Association for School Business Officials (ASBO) and fiscal health measures developed by the California Fiscal Crisis and Management Assistance Team (FCMAT), which works with ailing school districts. Second, I reviewed prior literature on budgeting and fiscal solvency among school districts. Third, I spoke with ten current chief financial officers in school districts outside of California as well as ten California districts not in the intended sample of 135 districts to identify current challenges to include in the survey. I also spoke to people currently or formerly working in

minute web-based survey distributed via email directly to the district budget officer at the end of fiscal 2009-10. It consists of 30 multiple choice questions and two open-ended questions concerning budget and financial planning practices, and planned or already-adopted responses to the current state budget crisis in California for fiscal year 2010-11.

*3.4 Methods of Analysis:* Building on my other essays, I examine whether revenue instability matters to districts, to what extent spending responses vary across districts, and what mechanisms districts use to cope with state budget cuts.

As predictors of spending responses, I consider several measures of a district's fiscal health. First is the long-term unpredictability in state revenues, which I discussed in section 3.1 as the measure of instability. The hypothesis here is that districts with greater long-term instability in state revenues may pursue different cuts than districts that can forecast upcoming state revenues more closely. The second measure is whether per-pupil revenues were cut in the year of the survey (e.g., for the 2010 survey, a decline from 2008-09 to 2009-10). Immediate revenue cuts may be more salient to districts than over-time trends. The third measure is the CFO's experience, which may be a proxy for either more knowledge and/or ability to cope with revenue shocks. Finally, I consider whether the district is a Basic Aid district, meaning it is funded locally and not state-reliant. In these districts, the per-pupil property tax revenue exceeds what the state would provide. As a result, Basic Aid districts may be less subject to state revenue volatility but more vulnerable to local tax fluctuations. I consider these fiscal health measures as predictors of key survey responses.

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school district business offices to incorporate their suggestions for high-priority questions. Finally, I piloted the survey with several economists and chief financial officers not in my survey sample to ensure the survey is easy to understand, easy to navigate on the web, and feasible to complete within 15 minutes.

As outcomes, I focus on adopted budget changes. In particular, I focus on spending response outcomes that reflect the severity or extent of budget cuts the district is pursuing. The outcomes of interest related to spending changes are:

i. Whether a district experienced a decline in instructional spending from 2008-09 to 2009-10.
ii. Whether a district adopted a "severe" budget cut, which means they cut 6 percent or more of their general fund budget from 2009-2010 to 2010-2011.
iii. Whether a district is raising or seeking local revenues from any source.
iv. Whether a district approved cuts to certified teaching staff.
v. Whether a district is negotiating a teacher contract that will include a hard cap on benefits.

The first outcome is from fiscal data available from the CDE. The remaining outcomes are dichotomous-response survey items. The required dichotomous questions captured variation among respondents without losing substantial respondents. I use logistic regression analysis and predict these responses with the fiscal health characteristics discussed earlier in this section; demographic characteristics including the proportion of students in poverty and changes in enrollment; and teacher characteristics, such as the number of teachers in the district and the proportion fully credentialed. I express results in terms of the log of the odds ratio:

$$x_i\beta = \log\left(\frac{p_i}{1-p_i}\right)$$

where $x_i\beta = \beta_{1d}(fiscal\ health\ indicators) + \beta_{3d}(student\ demographics) + \beta_{2d}(teacher\ characteristics) + u_d$[37]

One additional outcome I examine draw is the district's cash reserve level. Since this is a continuous variable, I use Ordinary Least Squares estimation of a linear regression model.

I do not intend to make a causal claim with this analysis. Rather, I intend to provide a descriptive portrait of increasingly constrained state budget setting and explore some relationships that merit further study in a causal framework. My underlying assumption is that changes in the fiscal climate and observed covariates are the only changes relevant to the outcomes of interest between 2006 and 2010. However, it is likely there are many unobserved changes I cannot capture. With only two years of data, I do not have enough power to use year fixed effects and multiple covariates for the items that appeared across years. I recognize omitted variable bias may drive some of my results. In addition, my estimates may have limited precision, due to the relatively small sample size. I will likely have an efficient estimator, as the sample variance with stratification is lower than it would be with simple random sampling (Deaton, 1996). I further address these estimation questions in the results and discussion sections.

[37] For outcomes that appear in both 2006 and 2010, the specification is for outcome *i* in district *d* with predictors in time *t*. I try to use a cross-sectional time-series regression to assess changes in response within a district between 2006 and 2010, but such models do not apply for most outcomes. In cases where an outcome appears in both years, I use logistic regression with responses pooled over time for each district.

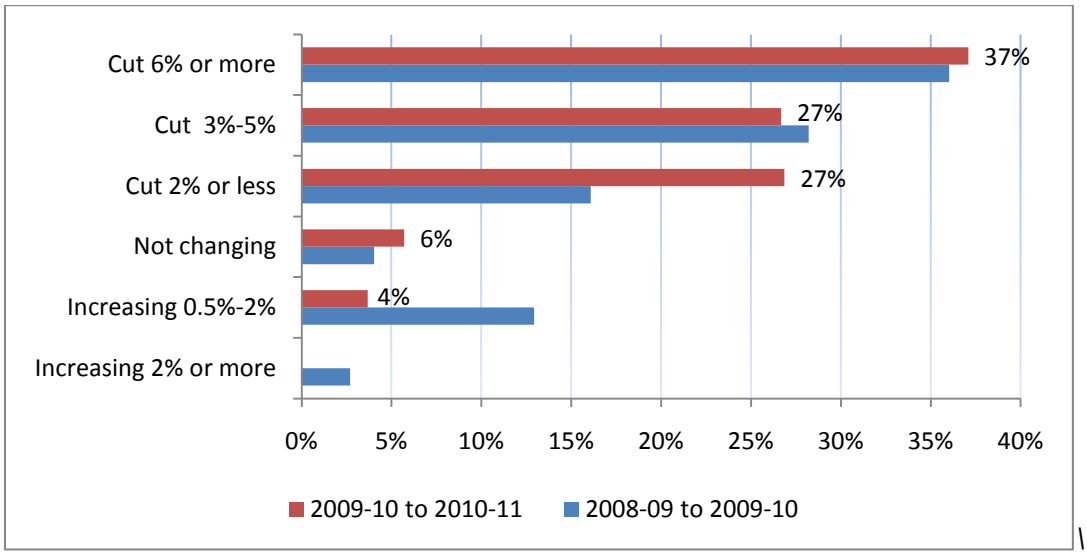
## IV. Results

In this section, I first describe the frequency of survey responses on key items. Then I discuss how they vary by several dimensions, using results of linear and logistic regression.

### *A. What approaches do California districts adopt to cope with state budget cuts?*

The survey asked about specific strategies adopted regarding cost-cutting, revenue-raising, and staffing for the 2010-11 fiscal year. First, it is useful to see district officers' self-reports of the extent of overall changes to the general fund. I asked them to report on changes relative to two time points. First, I asked *"Compared to FY2008-09, the budget for FY 2009-2010 was…"* and gave them options to quantify the degree of cuts. Second, I asked "*Compared to FY2009-10, the budget for FY 2010-2011 will be…"* and provided the same options. Figure 3 shows that a higher proportion of districts are pursuing cuts for the FY 2010-11 year compared to the proportion that pursued it for the 2009-10 year. Most interesting, about 13 percent of respondents reported an increase in their budget from 2008-09 to 2009-10, while only 4 percent of respondents reported any increase for the 2010-11 year. Nearly one-third of districts anticipate cutting their budget by 6 percent or more for the 2010-11 year. Some districts said they would cut their budget by more than 9 percent in one year. Overall, 90 percent of respondents report their general fund will experience some level of reduction.

**Figure 3.4. Budget cuts increase for 2010-11 year compared to the 2009-10 year.**

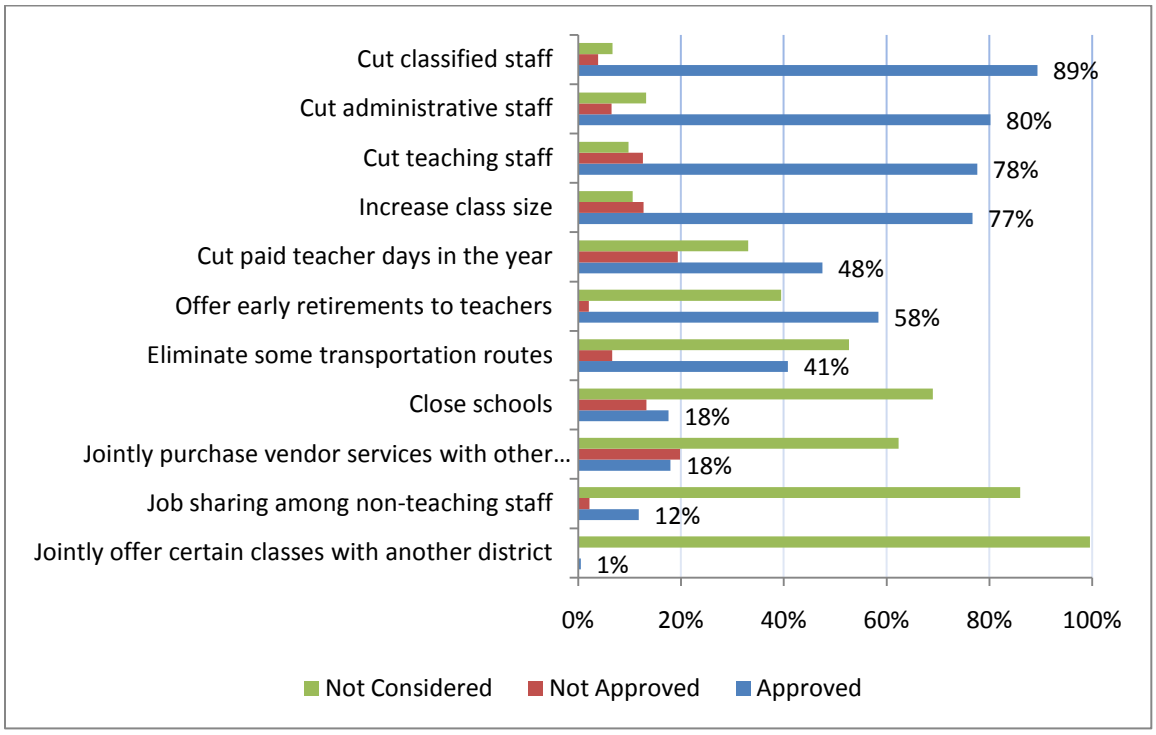



***Cost-cutting**:* When asked if the board had approved any cost-cutting measures for the 2010-11 fiscal year, 86 percent of districts answered yes. For those who answered yes, I asked whether the board had approved, not approved, or not considered specific measures. The most frequently approved strategies were cuts to administrative and classified staff (approvals shown in blue bars in Figure 4a). Cuts to teaching staff and class size increases were next most frequent at 78 and 77 percent, respectively. I asked about both class size increases and cuts to teaching staff because they capture different mechanisms for cost-cutting though with a potentially similar result. Cuts to teaching staff may free funds for improved management of programs (Loeb & Grissom, 2010). The increase in class size is likely a response to easing the requirement to spend categorical funds to reduce class size. This type of categorical flexibility began in 2009-10 and is scheduled to continue through the 2012-2013 fiscal year. In addition, districts appear to be using some flexibility relating to teacher contracts and the length of the

school year. Nearly 58 percent of districts offered early retirements to teachers, and 48 percent cut paid teacher days in the school year.

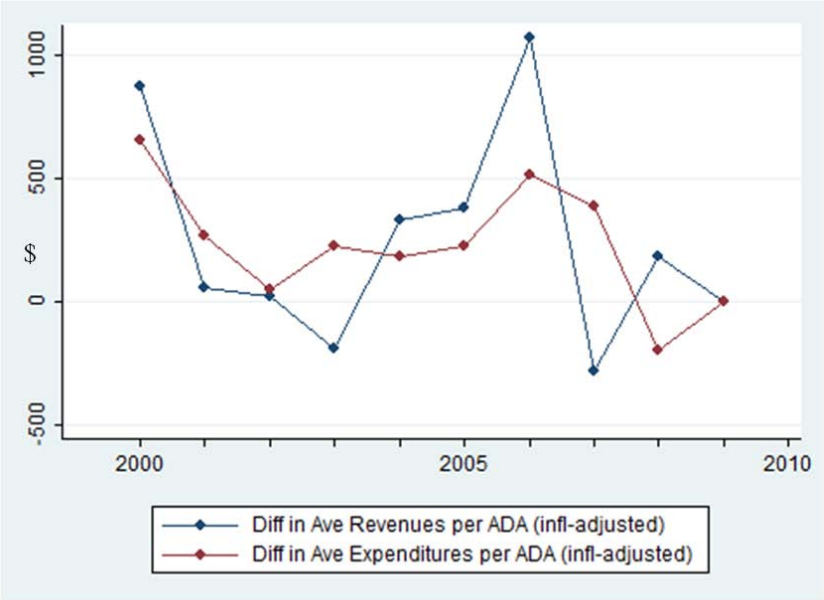
Notably, several cost-saving options were *not* considered by districts in the sample (displayed in ascending order in green bars in Figure 4a). Only one district considered the option to 'jointly offer certain classes with another district' or share instructional services. Similarly, job-sharing among teaching staff was not considered by more than four-fifths of the districts that pursued cuts. Nearly 70 percent of districts did not consider closing schools, while 18 percent of those pursuing cuts approved school closures. Those districts that did approve school closures were both large- and small-enrollment districts. However, 18 percent of districts did approve jointly purchasing vendor services with other districts, though an equal proportion voted down the option.

**Figure 3.5a. Districts approve staff cuts more than other cost-cutting options for FY2010-11.**



To illustrate why districts pursued such a wide range of cuts for fiscal year 2010-2011, it is helpful to examine the history of revenue and spending changes in the state until then. Figure 4b shows the average changes in total revenues per ADA (in 2008 dollars) and total expenditures per ADA from fiscal years 2000-2001 to 2008-2009 across all districts in the state. Revenues did not hold steady for even a single year during this time. One does not see an indication of smoothing spending against the revenue shock, but rather that districts adjust spending in proportion to revenue cuts in the prior year. Given that I am adjusting for inflation, one expects to observe some positive differences in revenues and spending in a given year compared to the prior year. The negative difference in spending in the fiscal year ending in 2008 suggests that districts had already cut a substantial portion of their budget. For the fiscal year ending in 2009, districts held their budgets at that reduced level, on average. Thus, districts may not have had much discretionary spending left to cut as a way to reduce costs while still protecting instructional staff and programs. Thus, by the time districts faced even more state budget cuts in FY 2009-2010, it is not surprising that district cost-cutting extended to instruction.

**Figure 3.5b. In response to year-to-year revenue changes, districts adjust spending.**



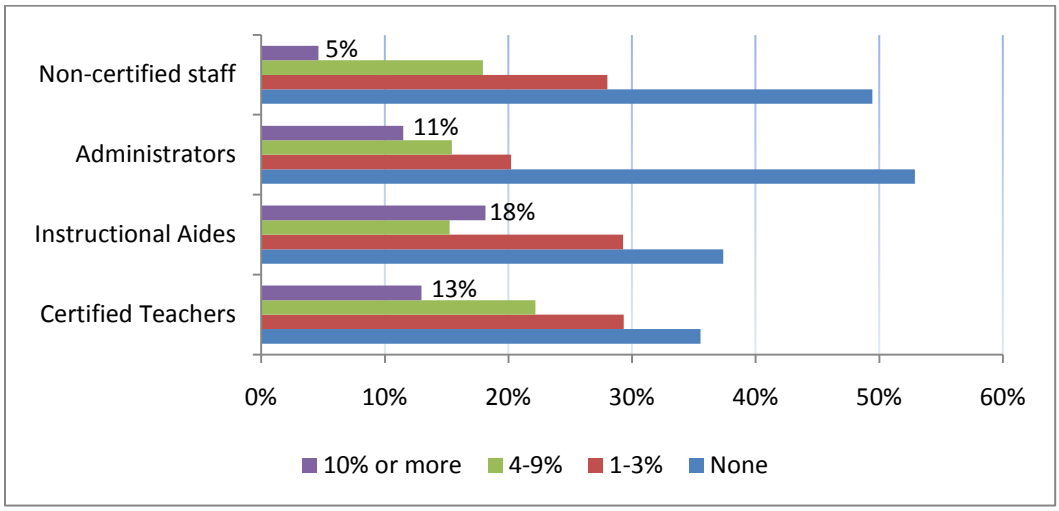

***Staffing:*** As suggested by the results on cost-cutting strategies, many districts are confronting staff cuts. At the time the survey was ready to be distributed in summer 2010, the forecast for state revenues looked to be worse than originally project. So I asked districts what reductions in force they anticipated above and beyond already approved staff cuts. Figure 5 shows the distribution of pink slip notifications among teachers, administrators, and support staff. Among the sample districts reporting in summer 2010, note the staff categories that were predicted to receive no layoff notices. More than half of districts aid administrators will not receive pink slips for 2010-11 (at the time of the survey), while certified teachers were least likely of all staff categories to receive no pink slips (about one-third of districts said they gave no pink slips to teachers). Nearly 13 percent of districts planned to reduce their teaching force by 10 percent or more. In addition, nearly one-fourth of districts said they planned to reduce their certified teaching

force by 4-9 percent. It is interesting that non-instructional, non-certified staff are not as hard-hit as certified teachers or instructional aides. This result may suggest that districts can no longer protect instructional staff, or that cuts to non-instructional staff had already occurred to the point that districts did not have surplus non-instructional staff they could release. Alternately, it may suggest that districts know they can re-hire a certain portion of teachers in the fall, so the number of pink slips may overstate the number of teachers lost from year to year. In short, districts may have more information about their staffing capacities than suggested by pink slip issuance.

Districts are also choosing to reduce staff days. More districts are choosing to cut teaching days rather than non-teaching days: 45 percent of districts are cutting 1-6 teaching days, while just 21 percent of districts are cutting non-teaching staff days. This may reflect that teaching days are more costly for districts, and that districts are taking advantage of the state's recent flexibility on the length of the school year that was part of the Ed-Flex program discussed in the Background section.

**Figure 3.6. Reductions in force affect all staff categories.**

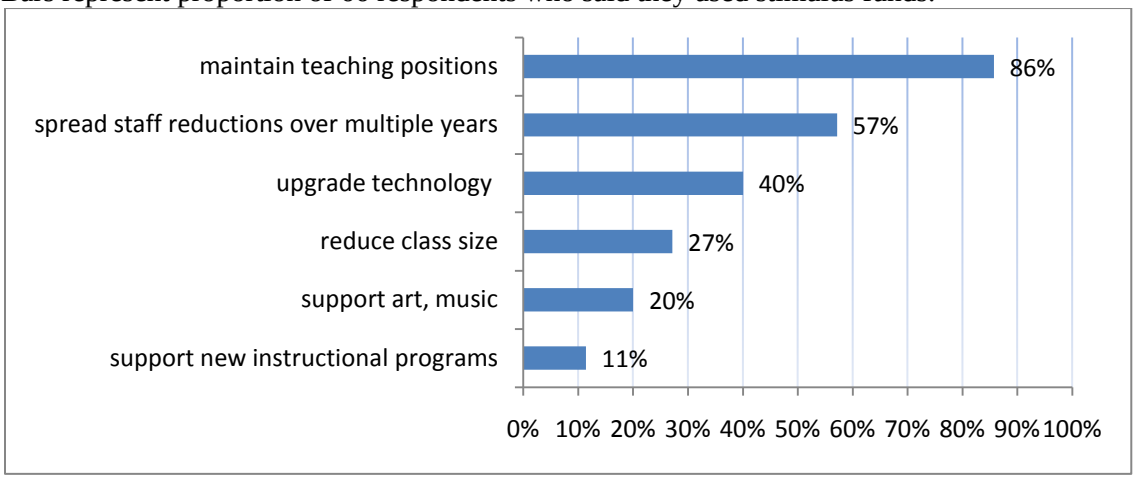
*Question stem: For each category below, what proportion of your staff has received pink slips for FY2010-2011?*



***Stimulus:*** I also asked districts how they had used federal stimulus funds (from the American Recovery and Reinvestment Act) in the 2009-10 fiscal year, to get a sense of cuts that might have occurred if not for the stimulus. Districts that used stimulus funds for one-time expenses in 2009-10 will likely not have to backfill those expenses in 2010-11. For instance, 28 of 66 districts used the funds to upgrade technology. However, the stimulus was introduced in part to preserve teaching jobs. The majority of respondents did, indeed, use the funds to maintain teaching positions, spread out staff reductions over years, or reduce class size, as shown in Figure 6. These salary expenditures are precisely the sort of operating costs that districts cannot cover in the face of reduced state and local revenues. To this end, in response to questions about reductions in force, 54 percent of respondents said they anticipated laying off 1-9 percent of their teachers, and another 16 percent said they anticipated laying off as much as 10-19 percent of their certified teachers in fiscal year 2010-11 (discussed further in the staffing section below). Although there is a significant, negative correlation for districts that used the stimulus funds to maintain teaching positions in 2009-11 and that planned to cut teaching staff for 2010-11 ($-0.38$, $p<.05$), it is likely that using federal funds to fill state funding gaps simply postpones reductions in the teaching force, and that we may observe more serious reductions in force in 2011-2012.

**Figure 3.7. Districts use federal stimulus funds to maintain instruction and reduce staff cuts.**

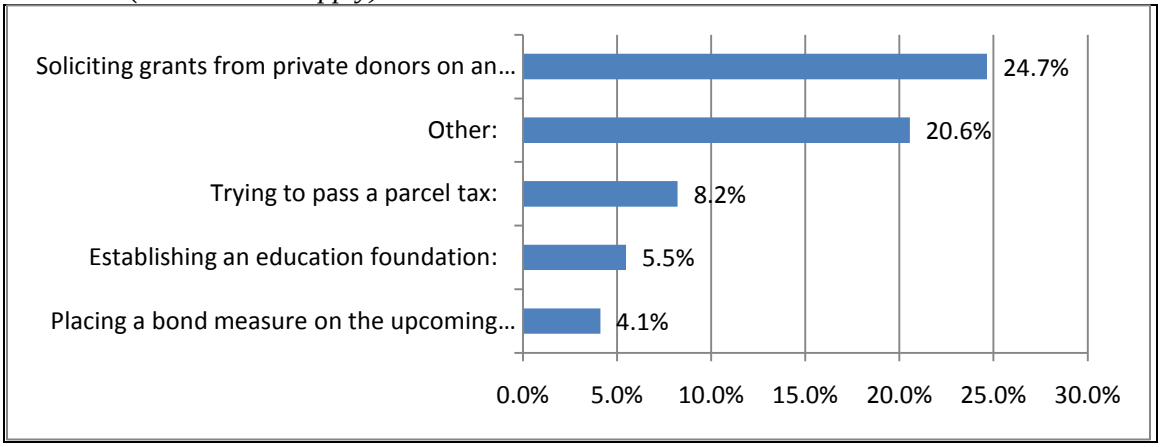
Bars represent proportion of 66 respondents who said they used stimulus funds.




***Revenue-raising:*** Next, I asked about revenue-raising strategies. Only 27 respondents (37 percent) said they were currently trying to generate additional *local* revenues. Of these respondents, soliciting grants from private donors was the most frequently cited, though in absolute terms it represents just 17 districts. The respondents who cited 'other' strategies stated they had already pursued parcel taxes, general obligation bonds, and had already established a strong local education foundation. Not surprisingly, a higher proportion of Basic Aid districts (those that do not receive state aid per pupil because their local property tax collections exceed what the state would provide) reported trying to general additional local revenues (71 percent Basic Aid vs. 30 percent other districts, $p<.01$). Figure 7 shows the distribution of responses.

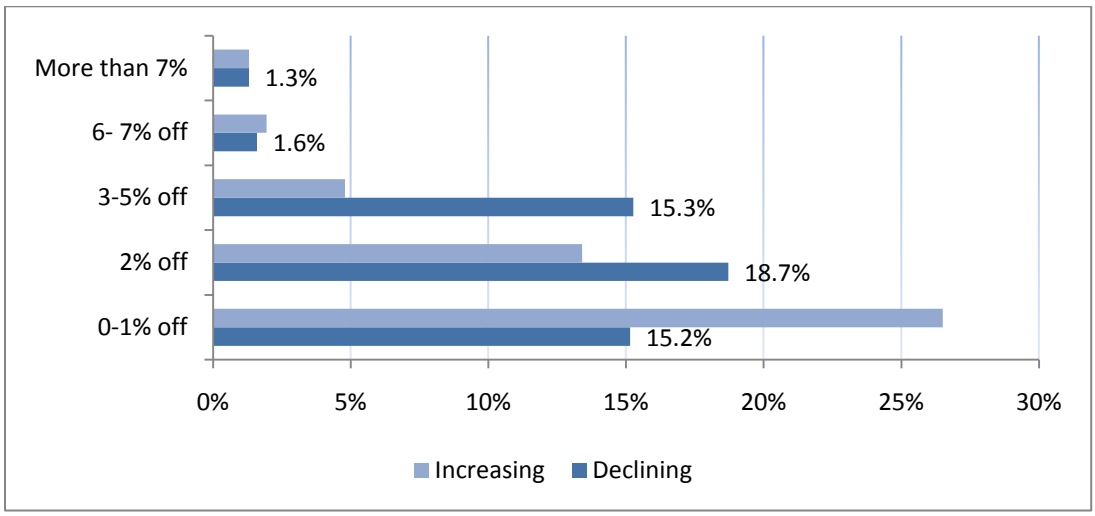
**Figure 3.8. Few districts pursue a parcel tax or bond measure to generate local revenues.**

*Question stem: What is your Local Education Agency currently doing to generate LOCAL revenues? (check all that apply)*




***Enrollment forecasts*:** An issue that affects both staffing and revenues is enrollment. Inaccurate enrollment predictions may mean excess hires or purchases of services and supplies, and over- or under-estimation of state aid per pupil. I asked budget officers to report how accurate their enrollment predictions have been since the 2007-2008 fiscal year, since that is when the housing bubble started to burst and student mobility increased for some districts. Figure 8 shows that a higher proportion of budget officers in increasing-enrollment districts (27 percent) estimate enrollment within 1 percent of actual enrollment, while just 15 percent of declining-enrollment district officers say they estimate enrollment as accurately. Declining-enrollment districts have a higher proportion of inaccurate estimations (2-5 percent different from actual) than increasing-enrollment districts do. Just 5 percent of increasing-enrollment districts misestimate enrollment by 3-5 percent, while 15 percent of declining-enrollment districts do. Declining enrollment may be another avenue through which districts lose revenues, but in a way they cannot forecast.

**Figure 3.9. A higher proportion of declining-enrollment districts estimate enrollment incorrectly.**




Source: Author's own survey and calculations of growth in Average Daily Attendance from California Department of Education data.

The descriptive results in this sub-section paint a picture of districts making steeper budget cuts than in prior years, rather than relying on revenue-raising or efficiency-enhancing efforts. In addition, districts are pursuing cuts that affect instructional staff and programs, rather than maintaining instructional staff at the expense of other programs. Finally, it appears that declining enrollment may itself be a form of fiscal instability for districts to manage.

**B.** ***How have responses changed from 2006 to 2010?*** To get a sense of whether district officers perceived the fiscal constraints and choices facing them in 2010 (when state revenues were declining) to be more severe than in 2006 (when state revenues were increasing), I examine whether districts change their responses to key items that were included in the 2006 and 2010 surveys. I present results from summary tabulations as well as from cross-sectional, time-series regressions to test whether change within districts is significant.

The first item concerned budget officers' perceptions about key factors for fiscal management. In response to the question *"How important do you believe each of the following is in order for your school district to remain in good fiscal health?"* the two surveys asked districts to rank importance on a scale of 1-4, with 1 representing 'essential' and 4 representing 'not important.' The average ranking districts assigned to the operational items below is not statistically significantly different between 2006 and 2010 (one cannot reject the null hypothesis that the values across years are equal), as shown in Table 3.4. This may be because factors such as stable district leadership and predictable state funding have been priorities for districts since the beginning of the decade, so there was not much room for district managers to increase the priority they assigned to those issues. In 2010, I also asked which of these factors was *most* important to planning and decision-making. 22 percent said cost controls related to salaries was the most important factor. *Half* of districts said predictable state funding was the most important factor for them. The proportion of districts citing the importance of predictable state funding increased from 67 percent in 2006 to 71 percent in 2010.

[Table 4 here]

Given that state revenues to districts fluctuated quite a bit between 2006 and 2010 (as shown earlier in Figure 3.4b) one might expect that revenue-unstable districts are more likely to cite predictable state funding as the most important factor. In tabulations across years, it appears that a higher proportion of *stable* districts than unstable districts cite predictable state funding as essential (81.3 percent vs. 18.8 percent, respectively), as shown in Table 5a. But this is not a formal test of the relationship. I use a logistic regression framework to test whether districts have changed their response from 2006 to 2010, as the state fiscal climate has become more constrained. I use a time-varying instability measure as the predictor, specifically the change in revenues that is not predicted by two prior years of revenues (the instability measure discussed in section 3.1). For a given district, a 1 percent increase in revenue instability between survey years is significantly associated with an increased likelihood of citing predictable state funding as essential. The magnitude is small (odds ratio of 1.001, $p<.05$), but it does demonstrate a significant relationship. These results confirm intuition: the more unpredictable a district's revenues are, and the more that unpredictability increases over time, the more likely it is to value predictability in state funding.

[Table 3.5a and 3.5b here]

In a separate but related question, I asked budget officers to rate state policies according to the extent they thought each contributed to unstable revenues for their district. The use of sales and income taxes to fund education was cited as a sizable contributor to instability by 73 percent of respondents. Limits on increasing local taxes were cited by 58 percent of respondents. This question appeared only in 2010, so I cannot

detect change over time. But the results reinforce the findings in Essay 2, that districts in states that rely on sales and income taxes to fund education are more revenue-unstable.

The second item I use to gauge whether budget officers perceive the current fiscal climate to be worse than in 2006 concerns negotiation or re-negotiation of the collective bargaining agreement with the district's primary teacher union. In response to the question *"Will the current contract you are negotiating with this union include..."* districts were offered the following options: pursuing a salary increase greater than the state's cost-of-living adjustment (COLA), a salary increase less than the state COLA, a salary freeze, or a rollback of prior salary agreements for the upcoming fiscal year. The change in the distribution of responses associated with the change in the fiscal climate between the two years is notable, as shown in Table 3.6. In 2006, no district said they were considering a salary freeze or a rollback for 2006-07, perhaps because the state revenues were increasing in that year. However, for the 2010-11 year, the proportion of districts pursuing any sort of salary increase dropped substantially, and more than half the respondents said they were pursuing either a salary freeze or a rollback of prior salary agreements.[38] The chi-squared statistic for this difference is significant at $p<.001$. This result raises the question of whether salary freezes and rollbacks can proceed because of teacher contract provisions or due to relationships between the superintendent, board and union representatives.

[Table 3.6 here]

The final item concerned which private sources of funding districts were seeking to supplement state aid. Among districts who reported seeking local sources of funding, I

[38] However, in 2010, only those districts that said they were re-negotiating an existing contract responded to the details of the salary changes. As a result, the absolute number and proportion of respondents among the 2010 sample is smaller than the respondent proportion for the 2006 survey.

asked which sources they were approaching. As Figure 6 illustrates, soliciting private grants is what many districts in 2010 are pursuing. But the proportion of districts pursuing grants from private foundations is lower in 2010 compared to 2006 (19 percent vs. 34 percent), and statistically significantly different at $p<.05$, as shown in Table 3.7. This result is not surprising, considering that private foundations themselves experienced shrinking endowments and may have been reducing the funds awarded to school districts. Notably, the proportion of districts relying on funds from local education foundations increased slightly to 56 percent (increase significant at $p<.05$). This may suggest that local supporters are considered more reliable during times of fiscal stress.

[Table 3.7 here]

In summary, budget officers appear to express that the fiscal climate in 2010 is worse than in 2006 (to the extent their responsibilities may feel less reasonable). Officers are pursuing more severe changes to union contracts, and are not pursuing foundation grants to the same degree as in 2006.

**C.** ***How do spending responses vary by district management characteristics?*** Prior literature on school finance has not exploited data on management experience of the district budget officer. One may hypothesize that more experienced budget officers may pursue different decisions related to current and future budget planning. I classify experienced CFOs as those with more than five years of total experience. Budget officers can transfer learning and budget practices across districts. Five years' experience is also a proxy for dealing with at least four state revenue changes, potentially providing the officer opportunity to develop strategies to cope with unpredictability in revenues. Table

3.8 shows summary statistics for district demographic and fiscal characteristics by budget officer experience (hereafter I refer to budget officers as CFOs for convenience).

In general, districts led by experienced CFOs are similar to those led by less-experienced CFOs. I use two-tailed t-tests to account for unequal variances between the two experience groups, and find only two variables to be significantly different at the 5 percent significance level: a district's Basic Aid status, and whether a district has high instability (both are lower for experienced CFOs). In terms of quality proxies, there are not significant differences between the two experience groups in terms of percent of credentialed teachers (about 96 percent) or the proportion of schools that made Academic Yearly Progress (68 percent). Demographic characteristics such as percent of English learners, students eligible for Free or Reduced-Price Lunch, and class size are similar between the two experience groups.

Experienced CFOs tend to work in much smaller districts as measured by students enrolled and number of teachers. Enrollment is 35.8 thousand for inexperienced CFOs and 14.7 thousand for experienced CFOs, but these differences are not statistically significant. In proportion to enrollment, the number of teachers is 1,729 for inexperienced CFOs and just 676 for experienced officers. This suggests that less experienced budget officers are having to manage larger payrolls and potentially more issues related to salary and benefits than their more experienced counterparts.

Given that small districts, on average, have more unstable revenues, as shown in Essay 1, it is interesting that experienced CFOs in California work in smaller districts. Despite working in small districts, the experienced-CFO group has a smaller proportion of revenue-unstable districts than the inexperienced group (just 22 percent compared to

48 percent, significant at p<.05). This division may reflect that districts struggling to cope with instability in state revenues cannot or do not hire more seasoned budget officers. Several other differences may relate to experienced CFOs serving in smaller districts. Average revenues and expenditures per pupil are lower for districts led by experienced CFOs than less experienced CFOs ($9,449 vs. $10,153 revenues per pupil, and $8,764 vs. $9,339 expenditures per pupil, respectively).

In terms of fiscal measures, the cash reserve percentage is higher in districts led by experienced CFOs than by less experienced ones (7.7 percent vs. 6.2 percent). Since we expect experienced CFOs to pursue financial planning and saving strategies, this distribution is what one would expect. Finally, a higher proportion of Basic Aid (locally funded) districts are led by less-experienced CFOs (35 percent compared to 11 percent).

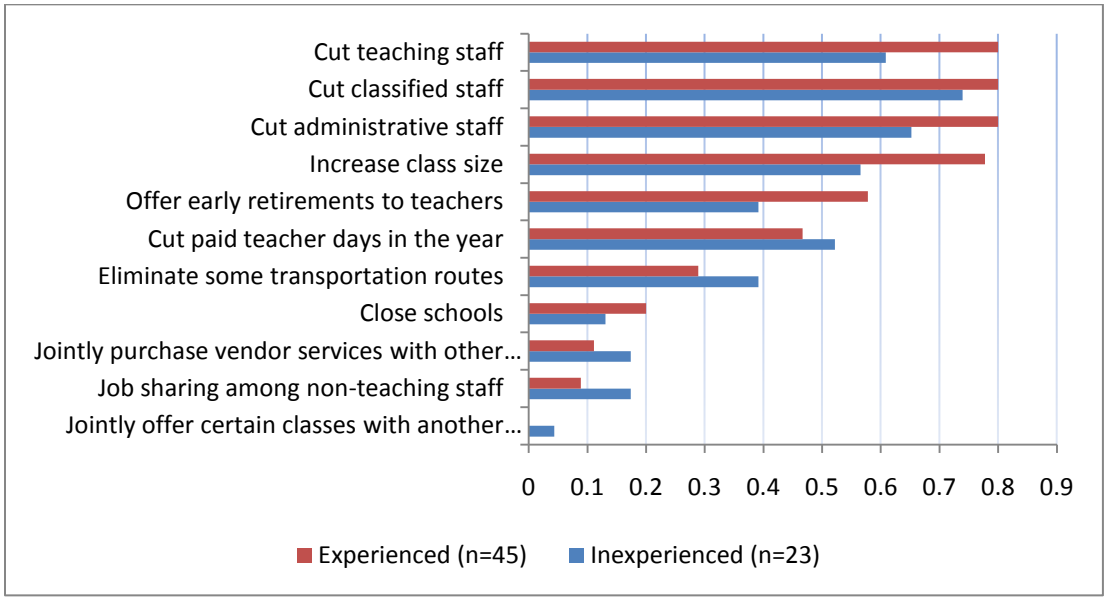
[Table 3.8 here]

Next I look at cross-tabulations of cost-cutting strategies pursued by CFO experience. (The cell sizes are too small to conduct regressions). Figure 9 presents cost-cutting strategies in descending order of board approval. Curiously, it appears that less experienced CFOs (shown with the blue bars) are more likely than experienced CFOs to pursue efficiency-enhancing measures, such as job-sharing, joint purchase of vendor services and consolidating transportation routes. It shows that regardless of CFO experience, cutting teaching, administrative and classified staff were the most prevalent strategies. However, a higher proportion of experienced CFOs, shown in the red bars, are pursuing staff cuts. Notably, no experienced CFO reported that the board did not approve these strategies, while several inexperienced CFOs reported that they could not get board approval for staff cuts. Table 3.9 shows this distribution. This result may be an artifact of

self-reporting, or a sign that experienced CFOs may have had time to build relations with the school board. A higher proportion of more experienced CFOs worked with school boards that approved early retirements for teachers than less experienced CFOs did.

[Table 3.9 here]

**Figure 3.10. Proportion of districts whose boards approved cost-cutting strategies, by CFO experience.**




Finally, the 2010 survey asked CFOs if they have changed their budget process in response to the recent state budget cuts. In response to the question *"In which of these ways has the planning and decision-making process most changed in your district?"* they could check either more centralized budgeting driven by the central office, more centralized budgeting driven by the school board, more site-based budgeting, or none of these option. Regardless of CFO experience, more than half of CFOs reported a move toward more centralized budgeting processes. Table 3.10 shows that less experienced CFOs reported this move was driven by the school board and the central office, while more experienced CFOs reported the move toward centralization by the central office. In

short, in a time of scarcity, budget officers take more control rather than continuing with decentralized structures.

[Table 3.10 here]

It appears that experienced CFOs maintain a healthier cash reserve fund, are pursuing a wider range of cost-cutting options, are able to obtain board approval for these cuts. These descriptive results suggest that fiscal management experience may moderate responses to revenues instability.

***D. How do spending responses vary by district's fiscal health?*** Recall from the Methods section that the measures of a district's fiscal health are: average unpredictability in state revenues, which I discussed in section 3.1 as the measure of instability; whether per-pupil revenues were cut in the year of the survey (e.g., for the 2010 survey, a decline from 2008-09 to 2009-10); the CFO's experience; and whether the district is a Basic Aid district. The outcomes of interest related to spending changes are:

- Whether a district experienced a decline in instructional spending from 2008-09 to 2009-10.
- Whether a district adopted a "severe" budget cut, which means they cut 6 percent or more of their general fund budget from 2009-2010 to 2010-2011.
- Whether a district is raising or seeking local revenues from any source.
- Whether a district approved cuts to certified teaching staff.
- Whether a district is negotiating a teacher contract that will include a hard cap on benefits.

In addition to these spending change outcomes, I examine what factors are associated with a district's cash reserve level. These results give a sense of which districts may be engaging in more advance planning or saving.

In this section, I first consider t-test results. Second, I present regressions with each fiscal health measure as a predictor. Next, I include student demographics to control for district composition and teacher characteristics to control for instructional spending obligations the district faces. Finally, I present results with a full set of fiscal and demographic predictors and controls. For some outcomes, I include interactions with a small district indicator. I use the small district interaction as a way to capture whether small districts make different decisions than their larger counterparts. One can consider low enrollment as being a risk factor, to the extent that initial descriptive evidence suggests that small districts are more revenue-unstable and may have less resource slack. When possible, I include a full set of interactions between whether a district has enrollment less than 1000 students and the fiscal health variables described above. I also interact the small district indicator with student covariates of interest. These covariates include indicators for whether a district is in the 75th percentile or above in terms of the proportion of its students who are English learners, racial minorities or eligible for Free and Reduced-Price Lunch. For some outcomes, the small-district interactions are collinear with other predictors of interest, and therefore I omit them.

*1) Differences between stable and unstable districts:* First, I verify whether revenue-stable and -unstable districts differ on observable characteristics, using a two-tailed t-tests. In Table 3.11, I compare how districts differ by whether they are above or below the sample mean in terms of the amount of revenue instability experienced from 1999-2008. For the purposes of survey analysis, I define mean instability with respect to the survey sample. Those sample districts that are above the mean revenue-instability level are classified as unstable or ‘high instability.’

Based on two-tailed t-tests of differences in means between revenue-unstable and revenue-stable survey sample districts, I find that average expenditures and revenues per average daily attendance (adjusted in 2008 dollars) are higher in the unstable districts than in the stable ones ($p<.05$). Unstable districts have much lower enrollment (3,572 versus 29,989 students); this division confirms the earlier point about a relationship between district size and revenue instability. Indeed, one-third of unstable-revenue districts are small (enrollment<1000), while just 8.5 percent are small in stable-revenue districts. This difference is significant at $p<.01$. A characteristic related to enrollment, pupils per teacher, is also lower in unstable-revenue districts than in stable-revenue districts (19.8 students vs. 22.0 students, significant at $p<.001$). As alluded to earlier, basic aid districts are indeed more concentrated in unstable-revenue districts (47 percent versus 6.4 percent in stable district, $p<.001$), suggesting their total revenues fluctuated more between 2000-2008 than state-reliant districts' revenues did. Curiously, the cash reserve level as a percentage of the general fund is higher in unstable than in stable districts ($p<.05$). This may reflect that unstable districts know they are exposed to instability and plan for it.

Other characteristics are not significantly different between the two district types. Average teacher salary is roughly comparable between unstable and stable districts ($67,142 versus $66,922). Student composition, such as percent English learners or percent eligible for Free/Reduced-Price Lunch are comparable as well (20.7 percent versus 19.6 percent, and 51.7 percent to 48.2 percent, respectively, between unstable and stable districts).

[Table 3.11 here]

Next, I examine whether the cuts districts pursue differ by revenue stability. Of the 11 cost-cutting options provided to districts in the 2010 survey (reviewed in Figure 3.4a), I use t-tests to examine whether the proportion of responses for each strategy varies by whether the district is revenue-stable or -unstable (again, because the cell size for approved strategies and revenue stability is too small for regression analysis). I find no significant differences, except for the cuts to administrative staff. I more formally test this relationship using cuts to certified teaching staff as an outcome, and examining whether high revenue instability is a significant predictor. I discuss these results below in section 4.d.iv. The lack of difference in cuts by instability may reflect that cuts adopted for 2010-11 have more to do with immediate revenue declines than with long-term revenue instability.

*2) Differences between declining- and increasing-revenue districts:* As a result, my next dimension of variation is whether log per-pupil revenues declined in the year of the survey (e.g. for 2010, from 2008-09 to 2009-10). My hypothesis here is that in the face of an immediate revenue decline, districts may pursue potentially more severe cuts to cope with the loss. I use t-tests for items that were answered through a skip logic, and therefore do not have a large enough response rate for estimation using regression analysis. A higher proportion of declining-revenue districts said they may lay off teachers with more than three years' experience than in increasing-revenue districts (75 percent vs. 27 percent; two-tailed t-test significant at $p<.05$). A higher proportion of declining-revenue districts approved early retirements and cuts to paid teacher days than increasing-revenue districts did (two-tailed t-test significant at $p<.1$). Based on these descriptive results indicating that revenue declines and revenue instability may be associated with

some changes in district, I include these as predictors in logistic regressions predicting survey answers about changes in budgeting in response to state cuts.

*3) Differences by all fiscal health measures:* Table 3.12 shows results from bivariate logistic regressions for three binary survey outcomes: the district is including a hard cap on benefits in the new teacher contract; the district is cutting teaching staff; and the district is raising local revenues. I use the four fiscal health measures discussed earlier as individual predictors for each of the five survey outcomes, to explore which of the fiscal health measures might be more salient. Not surprisingly, districts that have high revenue instability are 3 times more likely to pursue efforts to raise local revenues. And locally funded districts (Basic Aid) are 8 times more likely to pursue efforts to raise local revenues. Small districts (enrollment less than 1000 students) are less likely to cut teaching staff (odds ratio = 0.203, $p<.05$). To the extent that small districts do not have many surplus teachers, this result is not surprising.

[Table 3.12 here]

*4) Multivariate logistic regression results:* In this section, I use fiscal health indicators and district demographic covariates as predictors of the cash reserve level and the five outcomes concerning changes in spending. Student covariates include indicators for whether a district's student population is in the 75th percentile or above for percent racial minorities, English learners, or eligible for Free- or Reduced-Price Lunch. I also include an indicator for whether the district experienced growth in Average Daily Attendance (ADA) between 2005-06 and 2009-10. In addition, I include controls for average teacher salary and the number of total and fully credentialed teachers in the

district, as they provide indicators of the district's spending obligations. Finally, I control for revenues and expenditures per-pupil to control for different revenue and spending levels between districts.[39] I discuss the key results for each outcome below.

- *Cash reserve level:* First I consider what characteristics explain how large a district's cash reserve fund is, as a percentage of its general fund. Consider that in 2009 the state relinquished the requirement that districts maintain a minimum cash reserve of 3 percent. Previously almost all districts had maintained at least the 3 percent reserve. In 2010, 40 percent of survey respondents said their reserve level was less than 3 percent. However, more than 25 percent of sample also has reserve levels greater than 10 percent. This suggests that some districts are taking advantage of the flexibility, while others may not need to do so.

  The cash reserve level can serve as an outcome and predictor measure of fiscal health. So it is not surprising that the four fiscal health predictors are all significant predictors of the cash reserve level in bivariate specifications, as shown in Table 3.13. High prior revenue instability is associated with a 10 percentage point increase in the cash reserve level.

  An experienced CFO is associated with a 7.7 percentage point increase. And basic aid district status is associated with a nearly 11 percentage point increase. A decline in per-pupil revenues for 2009-10 is associated with a significant but small percentage point increase in the cash reserve level. This relationship becomes slightly negative once other fiscal and demographic controls are included. A district that is losing

[39] The tables show that I lose a few districts as I include revenue and expenditure covariates. I chose not to impute values because the change in state revenues and total expenditures per-pupil is so specific to each district's student composition and because the state categorical flexibility was introduced.

revenues may have fewer unused revenues to place in an unrestricted cash reserve fund. The actual revenues per average daily attendance are associated with an increase in the cash reserve level by nearly 4 percentage points in the full specification.

Among student demographics, attendance growth is associated with a 6 percentage point increase in the cash reserve level. This may suggest that more students provide economies of scale, such that districts can conserve the increase in revenues per pupil they receive for the future. However, the relationship to attendance growth disappears once the full set of fiscal characteristics and enrollment interactions are included.

[Table 3.13 here]

- *Instructional spending decline:* A key spending response outcome is whether per-pupil instructional expenditures declined in 2009-2010. Since the survey responses on cost-cutting suggest that districts are not able to preserve instructional staff and programs, it is useful to consider what district characteristics are associated with a decline in spending on instruction. Data for this outcome comes from the California Standardized Account Code Structure for 2008-09 and 2009-2010. I calculate the change between the two years, and create an indicator for whether the change is less than zero. The relevant concern for how district spending adjusts to revenue shocks is whether a district can hold spending steady. Of the 68 sample districts, 55 had instructional spending declines.

Table 3.14 shows that of the primary fiscal health predictors, high revenue instability in the past decade is associated with a decreased likelihood (odds ratio of

0.193) of a decline in instructional spending in 2009-10. This may point to the idea that districts exposed to instability learn to adapt or adjust spending to avoid cuts. Not surprisingly, a decline in per-pupil revenues between 2008-09 and 2009-10 almost perfectly predicts an instructional spending decline during the same time period (odds ratio of 1.001, $p<0.1$ in the bivariate model; odds ratio of 1.003, $p<.05$ in the full specification). CFO experience is not significantly associated with this outcome. Not surprisingly, the number of teachers in a district is significantly associated with instructional spending declines (odds ratio of 1.008, $p<.05$), controlling for other fiscal and demographic factors. When revenues are falling, districts with more teachers may be able to trim teaching staff without dramatically altering class sizes. Instructional spending in such a case would decline, but it may not necessarily mean that quality declines. Curiously, high-minority districts are associated with a far lower likelihood of instructional spending decline (odds ratio of 0.006, $p<.05$). This result, however, is not proof that districts with vulnerable student populations are spared steep cuts.

[Table 3.14 here]

- *Severe budget cuts:* I define severe budget cuts as whether a district reported cutting 6 percent or more of its budget from 2009-10 to 2010-11 in the survey. Notably, I find that none of the fiscal health predictors on their own is significantly associated with this choice, as shown in Table 3.15. Small districts are precisely the districts *not* pursuing cuts of 6 percent or more. This means the small district indicator perfectly predicts failure in the logistic regression, so I cannot include it as a predictor without losing observations. It also appears that high-minority districts are highly collinear

with the budget cut outcome. I find that high-minority districts (those in the 75th percentile or above in the state), are 19 times as likely ($p<.05$) to report severe budget cuts for 2010-2011 when controlling for other demographic characteristics, and 51 times more likely to report severe budget cuts for 2010-2011 when controlling for a full set of demographic and fiscal characteristics. Similarly, high English-learner districts are 21.9 times as likely to report severe cuts ($p<0.1$). Typically, high odds ratios suggest collinearity between the predictor and outcome, though high minority is defined relative to the state and not the survey sample, so it is not clear why the odds ratio is so high.

If the results are taken at face value, they have serious equity implications. They suggest that districts serving vulnerable students are engaging in steep cuts that will likely affect programs. The magnitude of the relationship between CFO experience and cuts is also striking. Experienced CFOs are 38.5 times as likely to pursue cuts of 6 percent or more, controlling for other demographic and fiscal characteristics. This result is consistent with cost-cutting results shown in Figure 3.9 that experienced CFOs are pursuing more cuts to staff and more types of cuts than their less experienced peers.

[Table 3.15 here]

- *Raising local revenues*: As in the bivariate analysis, districts with above average instability in state revenues are significantly more likely to pursue efforts to raise local revenues, when controlling for student and fiscal characteristics (odds ratio = 5.3, $p<0.1$, in the full specification, compared to 3.1 in the bivariate model). This result suggests that districts' prior receipt of state aid is associated with local

decisions and strategies they adopt. Notably, the cash reserve percentage and CFO experience are not significantly associated with the likelihood of local revenue-raising, either on their own or when controlling for other fiscal and demographic covariates. This may suggest that cash reserves are not substitutes for local revenues, nor vice versa. Table 3.16 shows these results.

[Table 3.16 here]

- *Cuts to teaching staff:* A decline in per-pupil revenues from 2008-09 to 2009-10 is associated with a slight increase in the likelihood of cutting certified teaching staff (odds ratio of 1.004, $p<.05$). This supports the idea that recent revenue cuts may be more salient for certain cost-cutting decisions than prior instability is. Neither instability nor any of the other fiscal health variables are significant predictors. Although one might expect the number of teachers to be associated with the likelihood of cutting teaching staff, it is not a significant predictor either on its own or when controlling for a full set of fiscal and demographic characteristics. The null finding here suggests there may be other mechanisms or decision-making rationale that is not captured by the variables in the model. These results are in Table 3.17.

[Table 3.17 here]

- *Benefits cap:* For the outcome of whether the district is including a hard cap on benefits in the new teacher contract, I pool responses from the 2006 and 2010 surveys. I find that experienced CFOs are significantly less likely to pursue this option, controlling for other fiscal and demographic characteristics (odds ratio of 0.35, $p<.05$). This is a curious finding, since experienced CFOs seemed inclined to

pursue a wide variety of cuts, including staff cuts. This result may reflect that experienced CFOs are reluctant to negotiate a difficult item. No other fiscal health measure or demographic characteristic is significantly associated with this response. These results are in Table 3.18.

[Table 3.18 here]

In summary, it appears that recent revenue declines and revenue instability are both important factors associated with district decisions to adjust spending. This finding supports the hypothesis that responsiveness is a function of two revenue mechanisms that indicate fiscal health: current revenue changes and prior instability. CFO experience is a significant factor for several key spending responses, including a district's cash reserve level and the severity of budget cuts it pursues. High-minority districts appear disproportionately exposed to budget cuts. It is unclear if high-minority districts are facing undue revenue cuts, or whether budget officers in those districts are making austere decisions in the face of continuing revenue declines.

## V. Discussion & Conclusion

This paper provides timely evidence on school district responses to state budget cuts in California, a state that has been experiencing severe reductions in appropriations for K-12 education for several years and that recently introduced changes to the funding timeline and structure for school districts. While other district surveys have been conducted recently, few link the results to district fiscal and demographic data to discuss how local district responses to revenue shocks vary by district characteristics. In particular, this paper links survey responses to district fiscal health measures and introduces a measure of instability in state revenues in order to capture both long-term trends as well as more recent state revenue cuts. It also exploits an under-studied factor in district financial decision-making: the experience of the district budget officer.

In terms of the role of fluctuations in California's funding for school districts, I find that half of districts sampled placed said predictable state funding was the most important factor for their district to remain in good fiscal health. Not surprisingly, districts with unpredictability in revenues over time are slightly more likely to cite predictable funding as essential.

The survey also addresses strategies districts use for cutting costs, raising revenues, and altering staffing. Even among a relatively small sample, there is evidence of variation in responses. For the 2010-11 year, budget officers report they are pursuing severe budget cuts (at least one-fourth of sample districts are cutting more than six percent of their budget), nearly half of districts are cutting teaching and non-instructional staff, and a smaller but notable proportion are changing union contracts to the extent that salaries may be frozen or rolled back. In addition, districts are pulling away from decentralized or site-based budgeting and moving toward more centralized budgeting.

However, less than half of districts are trying to raise local revenues, and of those few are pursuing parcel taxes or bond measures. As the public budgeting literature would suggest, local agencies are pursuing cost-cutting rather than revenue-raising in the face of state budget cuts. In short, budget officers perceived a more constrained environment for 2010-11 than they did for 2006-07. Although I cannot make a causal claim that the changing perception and responses are caused by changes in state revenues between 2006 and 2010, one can see that the patterns are strongly correlated.

Several district characteristics are worth noting. Experienced budget officers work in districts with lower enrollment, revenues and expenditures per pupil than their less-experienced counterparts. They also work in districts that are less revenue-unstable, a notable and statistically significant difference. They are more likely to maintain a higher cash reserve level and pursue a variety of budget cuts relative to their peers.

Districts with above average instability in state revenues differ significantly from their lower-instability peers in several ways. They have smaller enrollment and higher spending per pupil. High instability districts are also three times more likely to pursue options to raise local revenues. In a sign that highly unstable districts may be adapting to their exposure to unpredictable state revenues, such districts are associated with a lower likelihood of reducing instructional expenditures and with maintaining a higher cash reserve level for unexpected expenses. The findings in this paper support the argument that responsiveness is a function of both current revenue changes and prior instability.

There are several limitations to this analysis. First is the sample size. Though the sample is representative, one can imagine a wider range of mechanisms and variation in responses with a larger sample. In addition, one could explore geographic variation more

to understand if districts in the Central Valley respond differently than those near the border with Mexico, for example. The second limitation is the reporting error implicit in any survey that relies on self-reported changes. Though I tried to corroborate responses with administrative and fiscal data, the concern is that a different budget officer for the same district may provide different responses. The third limitation concerns generalizability to other states. California is extreme in its centralization of school finance. Other states have more variation in access to local revenues that could offset state revenue cuts. Thus, this study describes a case of how districts respond in an environment in which revenue-raising and receipt of state revenues is severely limited.

Despite these limitations, the study offers several important policy implications. If high-minority and high English-learner districts are, indeed, more likely to adopt severe budget cuts, it raises concerns about whether the state budget crisis is magnifying inequality between districts. There is also the broader question of what kinds of policy incentives or constraints shape the responses and relationships to district characteristics described here. Despite the efficiency, savings and learning benefits from shared instructional services, for example, districts may not necessarily see short-term rewards. Shared instruction may not deliver enough savings to warrant the coordination effort and time associated with it. Although shared instructional services are more common for special education or vocational education districts, K-12 labor contracts may not allow for consolidation of positions or classes so readily. In addition, joint powers agreements often relate more to transportation than to instruction. And the flexibility around use of categorical funds or contracting doesn't necessarily support shared instruction. Budget cuts are essentially a within-district decision, but efficiency and savings opportunities are

likely to occur between districts. Yet there are limited opportunities or incentives for districts to collaborate with each other, unless they are county-run.

If the state were able to incentivize the use of shared instructional services, or more union contracts included clauses to allow for shared instructional services or collaboration for online learning, it would be interesting to see what strategies districts would pursue. In addition, if districts simply had more time to react to state budget cuts and explore creative use of resources, reorganization of services through approaches like shared instruction might be easier to implement.

It may be that state policies as well as the state revenue cuts are rewarding strategies that hurt instructional quality, such as cuts in teaching staff and paid teacher days, rather than rewarding more creative or alternative use of resources to meet student needs. A cost-benefit analysis, paired with a well-identified evaluation of the effect of staff cuts on student outcomes, would shed light on whether short-term staff cuts are delivering enough savings to counteract the potential harm to instruction or inefficiencies in terms of administrator time involved in hiring and firing staff.

**Table 3.1a. Sample stratification used for 2006 survey sample.**

| District Size | Total | Basic Aid Districts | Negative Certification | Qualified Certification |
|---|---|---|---|---|
| Less than 1,000 | 24 | 7 | 2 | 1 |
| 1,000 to 4,999 | 28 | 6 | 0 | 4 |
| 5,000 to 9,999 | 24 | 1 | 1 | 3 |
| 10,000 to 19,999 | 19 | 1 | 0 | 2 |
| 20,000 to 30,000 | 21 | 1 | 1 | 1 |
| More than 30,000 | 19 | 0 | 2 | 0 |
| Totals | 135 | 16 | 6 | 11 |

Source: EdSource, 2006

**Table 3.1b. Comparison of district types in sample to California.**

| | District type | | | |
|---|---|---|---|---|
| | Basic Aid | Elementary | High | Unified |
| **Percentage in sample** | 19.1 | 42.6 | 7.3 | 50 |
| **Percentage in CA** | 12.8 | 56.9 | 8.7 | 34.4 |

Due to over-sampling of large districts, there are more Unified districts in my sample than in the state. Due to over-sampling of Basic Aid districts, there are more in my sample than in the state.

**Table 3.1c. Sample stratification in 2006 and 2010 versus statewide distribution of districts by enrollment strata.**

| | AY 2005-2006 | | AY 2009-2010 | | 2010 statewide | |
|---|---|---|---|---|---|---|
| Less than 1,000 | 24 | 17.8% | 11 | 16.2% | 389 | 40.7% |
| 1,000 to 4,999 | 28 | 20.7% | 19 | 27.9% | 294 | 30.7% |
| 5,000 to 9,999 | 24 | 17.8% | 9 | 13.2% | 114 | 11.9% |
| 10,000 to 19,999 | 19 | 14.1% | 8 | 11.8% | 83 | 8.7% |
| 20,000 to 30,000 | 21 | 15.6% | 13 | 19.1% | 43 | 4.5% |
| More than 30,000 | 19 | 14.1% | 8 | 11.8% | 34 | 3.6% |
| Totals | 135 | | 68 | | 957 | |

**Table 3.2a. Comparison of districts that stayed in sample vs. those that attrited shows no attrition bias on observable characteristics.**

| | Sample that remained | | | | | Sample that attrited | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Variable** | **Mean** | **S.D.** | **Min** | **Max** | **N** | **Mean** | **S.D.** | **Min** | **Max** | **N** |
| Enrollment | 22,918.100 | 87,602.340 | 85 | 727319 | 68 | 18,544.690 | 23,089.820 | 92 | 132482 | 67 |
| Expenditures per ADA | 8,502.202 | 1,619.596 | 7,043.374 | 16,179.140 | 68 | 8,835.254 | 2,015.085 | 7,020.223 | 20,075.100 | 67 |
| Revenues per ADA | 9,088.999 | 1,793.802 | 7,483.240 | 16,883.590 | 68 | 9,605.367 | 3,463.190 | 7,289.214 | 32,343.960 | 67 |
| Average Teacher Salary | 65,006.060 | 6,948.803 | 50,756.610 | 86,216.010 | 65 | 65,979.450 | 7,436.886 | 45,385.610 | 82,246.190 | 67 |
| Pct Teachers <2 Years' Experience | 6.107 | 4.667 | 0 | 33.3 | 68 | 6.768 | 4.550 | 0 | 23.5 | 67 |
| Pct Teachers Fully Credentialed | 94.507 | 7.192 | 48.44 | 100 | 68 | 94.439 | 4.873 | 68.75 | 100 | 67 |
| Pupils per Teacher | 21.016 | 2.288 | 13 | 25.6 | 68 | 20.503 | 2.773 | 13.5 | 26 | 67 |
| PctEnglishLearners | 19.512 | 15.955 | 0.4 | 69.1 | 67 | 20.377 | 16.081 | 0.7 | 65.5 | 67 |
| PctFreeReducedMeals | 42.925 | 24.833 | 0 | 90.7 | 68 | 40.627 | 25.850 | 0 | 93.9 | 67 |
| Proportion of schools in district that made AYP | 0.618 | 0.490 | 0 | 1 | 68 | 0.597 | 0.495 | 0 | 1 | 67 |
| Note: two-tailed t-test not significant at p<.1 for any variable | | | | | | | | | | |

**Table 3.2b. Comparison of demographic characteristics in survey sample to never-sampled districts in 2009-2010 academic year.**

| | Ever-sampled | | | | | | Never-sampled | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Variable** | **Mean** | **S.D.** | **Min** | **Max** | **N** | | **Mean** | **S.D.** | **Min** | **Max** | **N** |
| Enrollment | 20,832.32 | 65,136.19 | 85.00 | 727,319 | 130 | * | 4,161.57 | 7,435.00 | 5.00 | 93,589 | 848 |
| Expenditures per ADA | 8661.04 | 1819.45 | 7020.22 | 20075.10 | 130 | * | 9684.46 | 4009.16 | 5748.03 | 41382.71 | 836 |
| Revenues per ADA | 9335.27 | 2722.07 | 7289.21 | 32343.96 | 130 | * | 10521.77 | 4974.96 | 6783.20 | 51378.38 | 836 |
| Pupils per Teacher | 20.77 | 2.53 | 13 | 26 | 130 | * | 19.44 | 3.43 | 4.4 | 32.7 | 848 |
| Average Teacher Salary | 65477.30 | 7176.93 | 45385.61 | 86216.01 | 126 | * | 61359.06 | 7732.78 | 31922.83 | 91745.76 | 694 |
| Pct Teachers <2 Years' | 6.42 | 4.61 | 0 | 33.3 | 130 | | 6.40 | 7.63 | 0 | 100 | 848 |
| Pct Teachers Fully Credentialed | 94.47 | 6.17 | 48.4 | 100 | 130 | | 94.90 | 6.93 | 37.5 | 100 | 848 |
| Pct English Learners | 19.92 | 15.96 | 0.4 | 69.1 | 128 | | 20.52 | 18.55 | 0.1 | 89 | 754 |
| Pct Free/Reduced Meals | 41.83 | 25.25 | 0 | 93.9 | 130 | | 47.14 | 26.88 | 0 | 162.9 | 848 |
| Proportion of schools in district that made AYP | 0.61 | 0.49 | 0 | 1 | 130 | * | 0.68 | 0.47 | 0 | 1 | 844 |
| * = two-tailed t-test significant at p<.05 | | | | | | | | | | | |

Source: Analysis of California Department of Education demographic data.

**Table 3.2c. Comparison of demographic characteristics in survey sample to all districts statewide in 2009-2010 academic year.**

| | Sample | | | | | | Statewide | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Variable** | **Mean** | **S.D.** | **Min** | **Max** | **N** | | **Mean** | **S.D.** | **Min** | **Max** | **N** |
| Enrollment | 21,831.40 | 80,858.86 | 73 | 671,088 | 68 | | 6,381.79 | 23,859.19 | 8 | 671,088 | 957 |
| Expenditures per ADA | 8,958.72 | 1,763.36 | 7,341 | 17,383 | 68 | | 10,178.64 | 4,869.78 | 6,032 | 69,616 | 944 |
| Revenues per ADA | 9,687.87 | 1,957.87 | 7,960 | 18,923 | 68 | | 11,267.54 | 6,481.47 | 7,079 | 118,521 | 944 |
| Pupils per Teacher | 21.33 | 2.60 | 12.2 | 28.6 | 68 | * | 20.06 | 6.02 | 0.9 | 156 | 957 |
| Average Teacher Salary | 66,989.52 | 8,493.14 | 49,129 | 96,673 | 66 | | 63,350.22 | 9,247.43 | 35,280 | 99,905 | 804 |
| Pct Teachers <2 Years' Experience | 2.42 | 2.26 | 0 | 10 | 68 | * | 2.64 | 5.46 | 0 | 100 | 957 |
| Pct Teachers Fully Credentialed | 95.88 | 4.29 | 80 | 100 | 68 | | 96.39 | 5.88 | 4.23 | 100 | 956 |
| Pct English Learners | 19.92 | 16.38 | 0 | 72 | 68 | | 18.71 | 17.76 | 0 | 79 | 957 |
| Pct Free/Reduced Meals | 49.29 | 26.46 | 0 | 100 | 68 | | 52.16 | 27.44 | 0 | 186 | 957 |
| Proportion of schools in district that made AYP | 0.13 | 0.34 | 0 | 1 | 68 | * | 0.25 | 0.43 | 0 | 1 | 957 |
| * = two-tailed t-test significant at p<.05 | | | | | | | | | | | |

**Table 3.3. Comparison of survey sample to fiscal characteristics of California districts.**

| | 2009-2010 | |
|---|---|---|
| | **California districts** | **California survey sample** |
| **Fiscal characteristics** | **Mean/S.D.** | **Mean/S.D.** |
| Expenditures per pupil (total): includes non-capital K-12 operating expenditures (excludes special, adult and vocational education) | $6,478.29<br>[$4,935.72] | $5,735.56<br>[$2,885.23] |
| Instructional expenditures per pupil | $5,851.58<br>[$4,478.24] | $5,256.46<br>[$2,447.97] |
| Support service expenditures per pupil | $600.84<br>[$762.50] | $469.34<br>[$545.65] |
| Restricted resources as a percent of total expenditures | 17.38%<br>[10.47%] | 15.77%<br>[8.45%] |
| Average revenue instability, 1999-2008 (Squared residual from the lagged growth model, time-invariant) | 0.074<br>[0.11] | 0.046<br>[0.06] |
| **Number of districts** | **950** | **68** |

Source: Analysis of California Standardized Account Code Structure data, FY2009-2010. Due to missing financial data, the total sample for the state is less than the 957 for the year 2009-2010.

**Table 3.4. Operational factors retain ranking of importance between two survey years.**

*Question stem: How important is each of the following factors for your district to remain in good fiscal health?*

(1=Essential, 4=Not important)

| | 2005-6 | 2009-10 | |
|---|---|---|---|
| | **Mean** | **Mean** | **Difference** |
| Stability in district leadership | 1.47 | 1.42 | n.s. |
| Extra revenues raised by the school district or community | 2.65 | 2.87 | n.s. |
| Cost controls related to salaries | 1.24 | 1.22 | n.s. |
| Cost controls related to employee benefits | 1.21 | 1.19 | n.s. |
| Cost controls outside of personnel | 1.67 | 1.71 | n.s. |
| **Predictable state funding** | 1.4 | 1.34 | n.s. |

Note: Bolded item indicates factor rated as *most* important by 50 percent of sample districts.

**Table 3.5a. Revenue-stable districts cite predictable funding as essential for their district's financial health.**

| | Predictable funding is essential for district to remain in good fiscal health | | |
|---|---|---|---|
| | **No** | **Yes** | Total |
| **Stable Revenues** | 57.89 | **81.25** | 74.63 |
| **Unstable Revenues** | 42.11 | **18.75** | 25.37 |
| | 100 | 100 | 100 |
| Total number of districts in 2010 sample | 19 | 48 | 67 |
| | Pearson chi2(1) = 3.9212 Pr = 0.048 | | |

**Table 3.5b. Revenue-unstable districts are *less* likely to cite predictable funding as essential for their district's financial health.**

| **Dependent Variable: Predictable funding is essential for district to remain in good fiscal health** | |
|---|---|
| | **Cross-sectional, time-series logistic regression** |
| **Revenue instability (unpredictable change in revenues in each survey year)** | 1.001* |
| | [0.001] |
| N | 134 |
| Note: N represents 68 districts pooled across 2006 and 2010 | |
| Odds ratios with standard errors in parentheses | |
| * p<0.05, ** p<0.01, *** p<0.001 | |

**Table 3.6. In 2010-11, more districts consider changing collective bargaining agreement to adjust for reduced revenues.**

*Question stem: Will the current contract you are negotiating for [ the upcoming fiscal year] with this union include...*

| | [For 2006-7] | [For 2010-11] |
|---|---|---|
| A salary increase greater than the state COLA? | 22.1% | 1.6% |
| A salary increase less than the state COLA? | 77.9% | 4.4% |
| A salary freeze? | 0.0% | 45.8% |
| A rollback of prior salary agreements? | 0.0% | 48.3% |

Pearson chi2(3) = 65.0701 Pr = 0.000

**Table 3.7. Smaller proportion of districts expect to receive contributions from private foundations in FY 2010-2011 than in FY 2006-07.**

| ***Do you expect to receive private contributions from any of these sources in [fiscal year…]*** | | | |
|---|---|---|---|
| | **[2006-7]** | **[2010-11]** | |
| Private foundations | 34.3% | 19.1% | * |
| Local education foundation | 52.2% | 55.9% | * |
| Local business partnerships | 35.1% | 36.8% | * |
| Total Districts | 134 | 68 | |

Note: Categories are not mutually exclusive.
*: Differences between response years significant at p<.05; chi-squared test of change between years is significant at p<.001.

**Table 3.8. District demographic characteristics do not vary significantly by CFO experience.**

| | Inexperienced (n=23) | | | | | ExperiencedCFO (>5 years) (n=45) | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Mean | Std. Dev. | Min | Max | | Mean | Std. Dev. | Min | Max |
| Enrollment | 35,758.70 | 138,835.20 | 73 | 671,088 | | 14,713.00 | 12,845.46 | 155 | 47,327 |
| Pct English Learners | 25.26 | 21.37 | 0.20 | 69.60 | | 18.05 | 12.88 | 0.00 | 50.00 |
| Pct FRL | 45.98 | 28.73 | 0.00 | 91.40 | | 46.56 | 24.08 | 2.40 | 92.90 |
| Pupils per Teacher | 20.22 | 2.73 | 11.70 | 24.80 | | 21.12 | 2.09 | 14.90 | 25.10 |
| Made AYP | 0.68 | 0.48 | 0.00 | 1.00 | | 0.69 | 0.47 | 0.00 | 1.00 |
| NumberTeachers | 1,729.52 | 6,802.40 | 6 | 32872 | | 676.69 | 585.47 | 10 | 2313 |
| Pct Teachers Fully Credentialed | 95.27 | 5.66 | 80 | 100 | | 96.19 | 3.42 | 84.02 | 100.00 |
| District is Basic Aid (locally funded) | 0.35 | 0.49 | 0 | 1 | * | 0.11 | 0.32 | 0 | 1 |
| District's state revenues are unstable (=1 if above median) | 0.48 | 0.51 | 0 | 1 | * | 0.22 | 0.42 | 0 | 1 |
| PP revenue decline in 2009-10 from 2008-09 | 647.54 | 528.21 | -189.79 | 2039.41 | | 573.99 | 495.14 | -380.15 | 2138.96 |
| Revenues per pupil | 10,153.91 | 2,517.94 | 7,990 | 18,923 | | 9,449.67 | 1,579.69 | 7,960 | 16,077 |
| Expenditures per pupil | 9,339.65 | 2,165.36 | 7,384 | 17,383 | | 8,764.02 | 1,508.58 | 7,341 | 15,927 |
| Average Teacher Salary | 64,045.00 | 6,270.97 | 49,938 | 75,233 | | 67,113.86 | 8,098.96 | 52,845 | 91,127 |
| Cash Reserve Percentage | 6.20 | 6.86 | 0 | 25 | | 7.71 | 7.87 | 0 | 29 |
| * p<0.05, ** p<0.01, *** p<0.001 | | | | | | | | | |

**Table 3.9. Cost-cutting strategies adopted, by CFO experience, among those who reported board approval of any cost-cutting measures.**

*Question stem: Which of the following cost-cutting measures did your board approve for the FY2010-2011 budget?(check all that apply)*

| | Inexperienced (n=23) | | | Experienced CFO (>5 years) (n=45) | | |
|---|---|---|---|---|---|---|
| | Approved | Not Approved | Not Considered | Approved | Not Approved | Not Considered |
| Jointly offer certain classes with another district | 1 | 0 | 16 | 0 | 0 | 35 |
| Job sharing among non-teaching staff | 4 | 0 | 13 | 4 | 1 | 20 |
| Jointly purchase vendor services with other districts | 4 | 4 | 9 | 5 | 1 | 28 |
| Close schools | 3 | 3 | 10 | 9 | 4 | 25 |
| Eliminate some transportation routes | 9 | 2 | 6 | 13 | 2 | 21 |
| Cut paid teacher days in the year | 12 | 4 | 3 | 21 | 3 | 12 |
| Offer early retirements to teachers | 9 | 1 | 9 | 26 | 0 | 12 |
| Increase class size | 13 | 4 | 2 | 35 | 0 | 5 |
| Cut administrative staff | 15 | 2 | 1 | 36 | 0 | 3 |
| Cut classified staff | 17 | 2 | 1 | 36 | 0 | 3 |
| Cut teaching staff | 14 | 4 | 1 | 36 | 0 | 5 |

Note: Some respondents did not provide an answer for each cost-cutting strategy, so the rows do not always add across to 68.

**Table 3.10. Changes in district budgeting practices, by CFO experience, among those who answered that the district's budget process had changed.**

| | Inexperienced CFO | Experienced CFO (>5 years) | Total |
|---|---|---|---|
| **More centralized budgeting driven by central office** | 8 | 13 | 21 |
| More centralized budgeting driven by school board | **7** | 3 | 10 |
| More site-based budgeting | 4 | 4 | 8 |
| None of these | 3 | 7 | 10 |
| Total | 22 | 27 | 49 |

**Table 3.11. T-tests for survey sample divided by districts with stable versus unstable revenues show that spending and revenues are higher in unstable districts.**

(Instability measured as average residual from a lagged growth model of per-pupil state revenues from FY1999-2008; Unstable= above the sample mean).

| | STABLE REVENUES (n=47) | | | | | UNSTABLE REVENUES (n=21) | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Mean | Std. Dev. | Min | Max | Sig | Mean | Std. Dev. | Min | Max |
| Enrollment | 29,989.640 | 96,401.110 | 155 | 671088 | | 3,572.476 | 4,695.787 | 73 | 21296 |
| Small district (Enrollment<1000) | 0.085 | 0.282 | 0 | 1 | ** | 0.333 | 0.483 | 0 | 1 |
| Expenditures per ADA | 8,413.660 | 815.550 | 7341 | 11004 | *** | 10,178.620 | 2,574.116 | 7921 | 17383 |
| Revenues per ADA | 9,011.255 | 835.120 | 7960 | 11681 | *** | 11,202.190 | 2,784.534 | 8772 | 18923 |
| Average Teacher Salary | 66,922.890 | 5,962.864 | 56411 | 82395 | | 67,142.750 | 12,748.560 | 49129 | 96673 |
| Pct Teachers <2 Years' Experience | 2.566 | 2.293 | 0 | 10 | | 2.100 | 2.207 | 0 | 8.3 |
| Pct Teachers Fully Credentialed | 96.124 | 3.405 | 84.02 | 100 | | 95.338 | 5.879 | 80 | 100 |
| Pupils per Teacher | 22.015 | 1.688 | 18.9 | 25.8 | *** | 19.800 | 3.541 | 12.2 | 28.6 |
| Pct English Learners | 19.566 | 14.433 | 0 | 66 | | 20.719 | 20.464 | 0 | 72 |
| Pct Free/Reduced Meals | 48.204 | 22.961 | 0 | 100 | | 51.719 | 33.530 | 3.2 | 99.2 |
| High Pct Pct Free/Reduced Meals | 0.191 | 0.398 | 0 | 1 | + | 0.381 | 0.498 | 0 | 1 |
| High Minority | 0.298 | 0.462 | 0 | 1 | | 0.333 | 0.483 | 0 | 1 |
| High Pct English Learners | 0.213 | 0.414 | 0 | 1 | | 0.333 | 0.483 | 0 | 1 |
| Proportion of schools in district that made AYP | 0.085 | 0.282 | 0 | 1 | + | 0.238 | 0.436 | 0 | 1 |
| Basic Aid district | 0.064 | 0.247 | 0 | 1 | *** | 0.476 | 0.512 | 0 | 1 |
| Cash reserve level (percentage of general fund) | 5.870 | 6.150 | 0 | 20 | * | 10.176 | 9.462 | 0 | 29 |
| Reveune variability (standard deviation of unpredictability from 2000-2008) | 354.3872 | 89.78104 | 168.7953 | 506.6756 | *** | 958.4204 | 842.4984 | 454.6259 | 3773.756 |
| | | | | | | | | | |
| Note: High = >=75th percentile | | | | | | | | | |
| +: p<0.1* p<0.05, ** p<0.01, *** p<0.001 | | | | | | | | | |

Source: California Department of Education data and author's calculations.

Note: "High" means above the 75th percentile in the state. Sig column shows p-values for two-tailed t-test.

**Table 3.12. Summary of odds ratios from bivariate logistic regressions on survey outcomes with fiscal health measures as predictors.**

| | Dependent Variables | | |
|---|---|---|---|
| **Fiscal health predictors** | **New teacher contract will include hard cap on benefits^** | **District is cutting teaching staff** | **District is raising local revenues** |
| | | | |
| **District's state revenue instability from 2000-2008 is above median** | 0.963 | 0.423 | 3.143* |
| | [0.401] | [0.309] | [1.710] |
| | | | |
| N | 129 | 68 | 68 |
| Pseudo R-squared | 0.00042 | 0.02 | 0.05 |
| | | | |
| **District is Basic Aid (locally funded)** | 2.162 | 0.318 | 8.125** |
| | [1.166] | [0.260] | [5.867] |
| | | | |
| N | 129 | 68 | 68 |
| Pseudo R-squared | 0.0142 | 0.0714 | 0.11 |
| | | | |
| **Experienced CFO (>5 yrs)** | 0.502+ | 2.571 | 0.545 |
| | [0.203] | [1.817] | [0.286] |
| | | | |
| N | 129 | 68 | 68 |
| Pseudo R-squared | 0.0188 | 0.0353 | 0.0148 |
| | | | |
| **PP revenues declined in year of survey** | 2.500 | 0.130* | 0.783 |
| | [1.659] | [0.108] | [0.592] |
| | | | |
| N | 129 | 68 | 68 |
| Pseudo R-squared | 0.107 | 0.0353 | 0.00195 |
| | | | |
| **Small district (enrollment<1000)** | 0.806 | 0.203+ | 1.429 |
| | [0.414] | [0.175] | [0.950] |
| | | | |
| N | 129.000 | 60.000 | 68.000 |
| Pseudo R-squared | 0.677 | 0.077 | 0.593 |
| Odds ratios with standard errors in brackets | | | |
| +: p<0.1, * p<0.05, ** p<0.01, *** p<0.001 | | | |

**Table 3.13. Fiscal health variables are significant predictors of cash reserve levels.**

| | | Dependent Variable: Cash Reserve as Percentage of General Fund | | | | | |
|---|---|---|---|---|---|---|---|
| | Fiscal 1 | Fiscal 2 | Fiscal 3 | Fiscal 4 | Demographics | Demographics + fiscal health | Demographics + fiscal health + enrollment interactions |
| **High revenue instability (2000-2008)** | 10.176** | | | | | 1.676 | -1.469 |
| | [2.030] | | | | | [2.738] | [2.840] |
| **PP revenues declined in 2009-10 from 2008-09** | | 0.007** | | | | -0.006** | -0.006* |
| | | [0.001] | | | | [0.002] | [0.003] |
| **Experienced CFO (>5 yrs)** | | | 7.713** | | | 2.075 | -0.406 |
| | | | [1.169] | | | [1.654] | [1.623] |
| **District is Basic Aid District** | | | | 10.977** | | 1.676 | 3.032 |
| | | | | [2.153] | | [2.505] | [4.195] |
| **High FRL** | | | | | 8.700* | 4.672 | 4.902 |
| | | | | | [4.108] | [3.298] | [4.210] |
| **High Minority** | | | | | -2.421 | -2.354 | -3.556 |
| | | | | | [2.580] | [2.093] | [2.151] |
| **High EL** | | | | | -2.941 | -5.962+ | -4.711 |
| | | | | | [3.313] | [2.984] | [3.531] |
| **ADAgrowth** | | | | | 6.037** | -1.258 | -1.450 |
| | | | | | [1.179] | [1.752] | [2.102] |
| **Number of Teachers** | | | | | | -0.000 | -0.000 |
| | | | | | | [0.000] | [0.000] |
| **Average Teacher Salary, in 1000s** | | | | | | 0.021 | -0.001 |
| | | | | | | [0.092] | [0.163] |
| **Revenues per ADA, in 1000s** | | | | | | 5.561** | 3.987+ |
| | | | | | | [1.881] | [2.003] |
| **Expenditures per ADA, in 1000s** | | | | | | -5.022* | -2.308 |
| | | | | | | [2.138] | [2.107] |
| **Small district (Enrollment < 1000 students)** | | | | | | | 0.000 |
| | | | | | | | [0.000] |
| **Pct Teachers Fully Credentialed** | | | | | | | -0.053 |
| | | | | | | | [0.147] |
| **Made AYP** | | | | | | | -1.187 |
| | | | | | | | [3.717] |
| **Interactions with small district** | | | | | | | X |
| **Number of Cases** | 68 | 68 | 68 | 68 | 68 | 68 | 68 |
| **R-Squared** | 0.297 | 0.252 | 0.366 | 0.214 | 0.298 | 0.671 | 0.783 |
| +: p<0.1* p<0.05, ** p<0.01, *** p<0.001 | | | | | | | |

**Table 3.14. Revenue decline and number of teachers predicts decline in instructional expenditures.**

| | Dependent Variable: Instructional expenditures declined in 2009-2010^ | | | | |
|---|---|---|---|---|---|
| | Fiscal 1 | Fiscal 2 | Fiscal 3 | Demographics | Demographics + tchr + fiscal |
| **High revenue instability (2000-2008)** | 0.193* | | | | 0.221 |
| | [0.126] | | | | [0.252] |
| **PP revenues declined in 2009-10 from 2008-09** | | 1.001+ | | | 1.003* |
| | | [0.001] | | | [0.001] |
| **Experienced CFO (>5 yrs)** | | | 1.916 | | 2.285 |
| | | | [1.204] | | [2.623] |
| **High FRL** | | | | 1.399 | 2.020 |
| | | | | [1.327] | [4.066] |
| **High Minority** | | | | 0.482 | 0.006* |
| | | | | [0.378] | [0.014] |
| **High EL** | | | | 0.953 | 11.207 |
| | | | | [0.862] | [25.016] |
| **ADAgrowth** | | | | 1.251 | 0.662 |
| | | | | [0.822] | [0.717] |
| **Small district (Enrollment < 1000 students)** | | | | | 1.374 |
| | | | | | [1.934] |
| **Number of Teachers** | | | | | 1.008* |
| | | | | | [0.004] |
| **Pct Teachers Fully Credentialed** | | | | | 0.899 |
| | | | | | [0.182] |
| **Average Teacher Salary, in 1000s** | | | | | 0.825+ |
| | | | | | [0.087] |
| **Revenues per ADA, in 1000s** | | | | | 0.173+ |
| | | | | | [0.180] |
| **Expenditures per ADA, in 1000s** | | | | | 13.161+ |
| | | | | | [18.926] |
| Number of Cases | 68 | 68 | 68 | 68 | 66 |
| R-Squared | 0.099 | 0.048 | 0.016 | 0.016 | 0.461 |
| Odds ratio with standard errors in brackets | | | | | |
| +: p<0.1* p<0.05, ** p<0.01, *** p<0.001 | | | | | |
| ^: In thousands of dollars | | | | | |

**Table 3.15. Proportion of English learner and minority students strongly predicts whether district adopts large budget cuts.**

| | Dependent Variable: District is cutting 6% or more of budget for 2010-2011 | | | | | |
|---|---|---|---|---|---|---|
| **High revenue instability (2000-2008)** | 0.436 | | | | | 0.282 |
| | [0.307] | | | | | [0.452] |
| **PP revenues declined in 2009-10 from 2008-09** | | 1.000 | | | | 1.003 |
| | | [0.001] | | | | [0.002] |
| **Experienced CFO (>5 yrs)** | | | 2.708 | | | 38.568* |
| | | | [1.899] | | | [62.206] |
| **District is Basic Aid District** | | | | 0.222 | | 21.239 |
| | | | | [0.241] | | [65.828] |
| **High FRL** | | | | | 0.271 | 0.236 |
| | | | | | [0.285] | [0.344] |
| **High Minority** | | | | | 19.189** | 51.416** |
| | | | | | [16.598] | [66.536] |
| **High EL** | | | | | 1.258 | 21.960+ |
| | | | | | [1.225] | [38.490] |
| **ADAgrowth** | | | | | 1.154 | 0.251 |
| | | | | | [0.827] | [0.304] |
| **Number of Teachers** | | | | | | 1.000 |
| | | | | | | [0.000] |
| **Pct Teachers Fully Credentialed** | | | | | | 0.632* |
| | | | | | | [0.127] |
| **Average Teacher Salary, in 1000s** | | | | | | 1.088 |
| | | | | | | [0.083] |
| **Revenues per ADA, in 1000s** | | | | | | 0.103+ |
| | | | | | | [0.129] |
| **Expenditures per ADA, in 1000s** | | | | | | 0.799 |
| | | | | | | [0.896] |
| Number of Cases | 68.000 | 68.000 | 68.000 | 68.000 | 68.000 | 66.000 |
| Pseudo R-Squared | 0.021 | 0.001 | 0.031 | 0.036 | 0.220 | 0.523 |

**Table 3.16. Revenue instability is significantly associated with raising local revenues.**

| | | | Dependent Variable: District is raising local revenues | | | | |
|---|---|---|---|---|---|---|---|
| | Fiscal 1 | Fiscal 2 | Fiscal 3 | Fiscal 4 | Fiscal 5 | Demographics | Demographics + fiscal health |
| **High revenue instability (2000-2008)** | 3.143* | | | | | | 5.356+ |
| | [1.710] | | | | | | [5.293] |
| **PP revenues declined in 2009-10 from 2008-09** | | 1.000 | | | | | 0.999 |
| | | [0.001] | | | | | [0.001] |
| **Experienced CFO (>5 yrs)** | | | 0.545 | | | | 0.738 |
| | | | [0.286] | | | | [0.583] |
| **District is Basic Aid District** | | | | 8.125** | | | 8.001 |
| | | | | [5.867] | | | [10.337] |
| **Cash reserve as percentage of general fund** | | | | | 0.973 | | 0.915 |
| | | | | | [0.034] | | [0.057] |
| **High FRL** | | | | | | 0.878 | 0.910 |
| | | | | | | [0.732] | [1.184] |
| **High Minority** | | | | | | 1.489 | 2.114 |
| | | | | | | [1.077] | [2.116] |
| **High EL** | | | | | | 0.924 | 0.789 |
| | | | | | | [0.691] | [0.870] |
| **ADAgrowth** | | | | | | 0.598 | 0.499 |
| | | | | | | [0.312] | [0.368] |
| **Small district (Enrollment < 1000 students)** | | | | | | | 2.192 |
| | | | | | | | [2.902] |
| **Number of Teachers** | | | | | | | 1.001+ |
| | | | | | | | [0.001] |
| **Pct Teachers Fully Credentialed** | | | | | | | 0.991 |
| | | | | | | | [0.104] |
| **Average Teacher Salary, in 1000s** | | | | | | | 1.052 |
| | | | | | | | [0.057] |
| **Revenues per ADA, in 1000s** | | | | | | | 1.111 |
| | | | | | | | [0.808] |
| **Expenditures per ADA, in 1000s** | | | | | | | 0.938 |
| | | | | | | | [0.689] |
| **Number of Cases** | 68 | 68 | 68 | 68 | 68 | 68 | 66 |
| **Pseudo R-Squared** | 0.050 | 0.009 | 0.015 | 0.112 | 0.007 | 0.014 | 0.302 |
| Odds ratios with standard errors in parentheses | | | | | | | |
| +: p<0.1* p<0.05, ** p<0.01, *** p<0.001 | | | | | | | |
| Note: Small enrollment indicator is collinear with outcome, so interactions are omitted. | | | | | | | |

**Table 3.17. Revenue decline predict cuts to teaching staff.**

| | Dependent Variable: District is cutting certified teaching staff | | | | | | |
|---|---|---|---|---|---|---|---|
| | Fiscal 1 | Fiscal 2 | Fiscal 3 | Fiscal 4 | Demographics | Teacher characteristics | Demographics + tchr + fiscal health |
| **High revenue instability (2000-2008)** | 0.423 | | | | | | 4.760 |
| | [0.309] | | | | | | [6.902] |
| **PP revenues declined in 2009-10 from 2008-09** | | 1.000 | | | | | 1.004* |
| | | [0.001] | | | | | [0.002] |
| **Experienced CFO (>5 yrs)** | | | 2.571 | | | | 3.913 |
| | | | [1.817] | | | | [3.866] |
| **District is Basic Aid District** | | | | 0.318 | | | 0.570 |
| | | | | [0.260] | | | [0.963] |
| **High FRL** | | | | | 0.126+ | | 0.057 |
| | | | | | [0.150] | | [0.130] |
| **High Minority** | | | | | 2.015 | | 2.796 |
| | | | | | [2.220] | | [4.742] |
| **High EL** | | | | | 4.552 | | 10.167 |
| | | | | | [5.543] | | [18.335] |
| **ADAgrowth** | | | | | 1.349 | | 1.146 |
| | | | | | [1.018] | | [1.141] |
| **Number of Teachers** | | | | | | 1.001 | 1.000 |
| | | | | | | [0.001] | [0.000] |
| **Pct Teachers Fully Credentialed** | | | | | | 1.113 | 1.273 |
| | | | | | | [0.087] | [0.197] |
| **Average Teacher Salary, in 1000s** | | | | | | 0.959 | 0.955 |
| | | | | | | [0.045] | [0.085] |
| **Revenues per ADA, in 1000s** | | | | | | | 0.122 |
| | | | | | | | [0.172] |
| **Expenditures per ADA, in 1000s** | | | | | | | 5.370 |
| | | | | | | | [7.201] |
| **Small district (Enrollment < 1000 students)** | | | | | | | 3.341 |
| | | | | | | | [6.622] |
| **Number of Cases** | 60 | 60 | 60 | 60 | 60 | 60 | 60 |
| **Pseudo R-Squared** | 0.025 | 0.005 | 0.033 | 0.034 | 0.079 | 0.067 | 0.315 |
| Odds ratios with standard errors in parentheses | | | | | | | |
| +: p<0.1* p<0.05, ** p<0.01, *** p<0.001 | | | | | | | |
| Note: Small enrollment indicator is collinear with outcome, so interactions are omitted. | | | | | | | |

**Table 3.18. Experienced CFOs are less likely to pursue a benefits cap.**

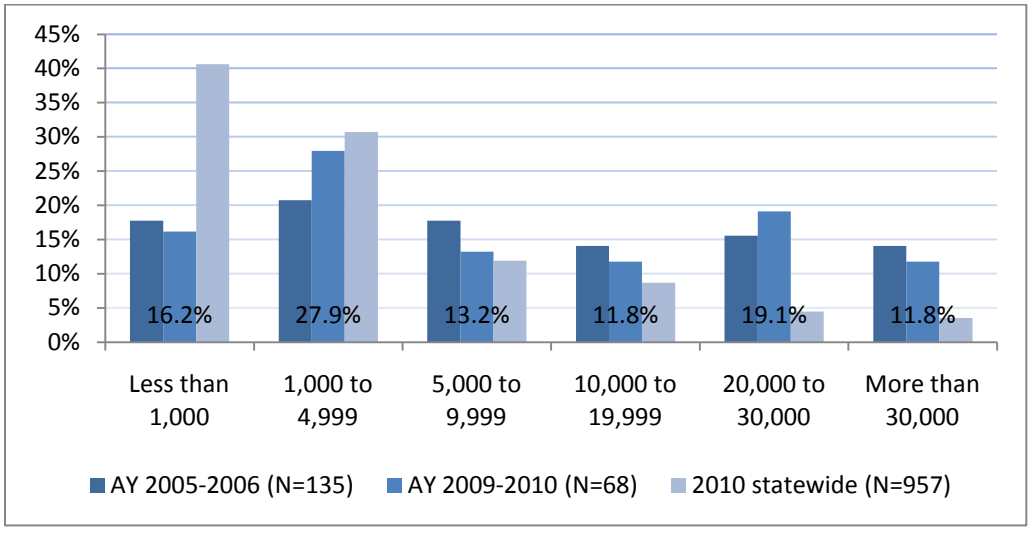
| | Dependent Variable: Will the current contract with this union include a hard cap on the per-employee cost of health and welfare benefits? | | | | | | |
|---|---|---|---|---|---|---|---|
| | Fiscal 1 | Fiscal 2 | Fiscal 3 | Fiscal 4 | Demographics | Tchr chs | Demographics + fiscal health |
| **High revenue instability (2000-2008)** | 0.963 | | | | | | 0.449 |
| | [0.401] | | | | | | [0.297] |
| **PP revenues declined in 2009-10 from 2008-09** | | 1.000 | | | | | 1.000 |
| | | [0.000] | | | | | [0.001] |
| **Experienced CFO (>5 yrs)** | | | 0.502+ | | | | 0.352* |
| | | | [0.203] | | | | [0.172] |
| **District is Basic Aid District** | | | | 2.162 | | | 2.338 |
| | | | | [1.166] | | | [2.282] |
| **High FRL** | | | | | 0.888 | | 1.278 |
| | | | | | [0.577] | | [1.112] |
| **High Minority** | | | | | 0.929 | | 1.357 |
| | | | | | [0.463] | | [0.819] |
| **High EL** | | | | | 0.879 | | 0.637 |
| | | | | | [0.555] | | [0.523] |
| **Number of Teachers** | | | | | | 1.000 | 1.000 |
| | | | | | | [0.000] | [0.000] |
| **Pct Teachers Fully Credentialed** | | | | | | 1.056 | 1.058 |
| | | | | | | [0.036] | [0.051] |
| **Average Teacher Salary, in 1000s** | | | | | | | 0.998 |
| | | | | | | | [0.037] |
| **Revenues per ADA, in 1000s** | | | | | | | 1.034 |
| | | | | | | | [0.525] |
| **Expenditures per ADA, in 1000s** | | | | | | | 1.339 |
| | | | | | | | [0.694] |
| **Small district (Enrollment < 1000 students)** | | | | | | | 0.335 |
| | | | | | | | [0.254] |
| **Number of Cases** | 129 | 129 | 129 | 129 | 129 | 129 | 123 |
| **Pseudo R-Squared** | 0.928 | 0.985 | 0.083 | 0.133 | 0.937 | 0.162 | 0.306 |
| Note: N represents districts pooled across 2006 and 2010. All fiscal variables are CPI-U adjusted in 2008 dollars | | | | | | | |
| Odds ratios with standard errors in brackets | | | | | | | |
| +: p<0.1* p<0.05, ** p<0.01, *** p<0.001 | | | | | | | |

## APPENDIX A3.1: WEIGHTING SURVEY RESULTS

Given my focus on district decision-making, rather than student outcomes, one may want to verify whether I have a sample of districts that represents the population of *districts* in the state. This section presents the construction of population weights and discusses the advantages and disadvantages of using weights.

The 2006 sampling intended to represent the student population, which meant small districts were under-sampled and large districts were oversampled (see Figure A1). However, districts in 2006 were also purposively sampled on financial health, making it difficult to construct an accurate probability sample weight that would represent each enrollment stratum-by-financial health cell.

**Figure A1. Distribution of districts in sample by enrollment strata illustrates the need to weight smaller districts more heavily.**



If I weight, it is logical to weight district respondents up to the population of non-charter *districts* (not student population). I use the same enrollment strata in 2010 as was used in 2006. I construct separate weights for each year, since the number of sample and total districts in each stratum varied slightly from 2006 to 2010. To avoid giving excessive weight to the decisions of the few large districts in the state, I consider a weight, $w_d$, for each stratum that is inverse to the probability of selection into the sample ($\pi_d$):

$$w_d = (n\pi_d)^{-1}$$

Table A3.1 presents the weights generated in each strata for each year.

**Table A3.1. District population weighting (by inverse probability of selection into sample).**

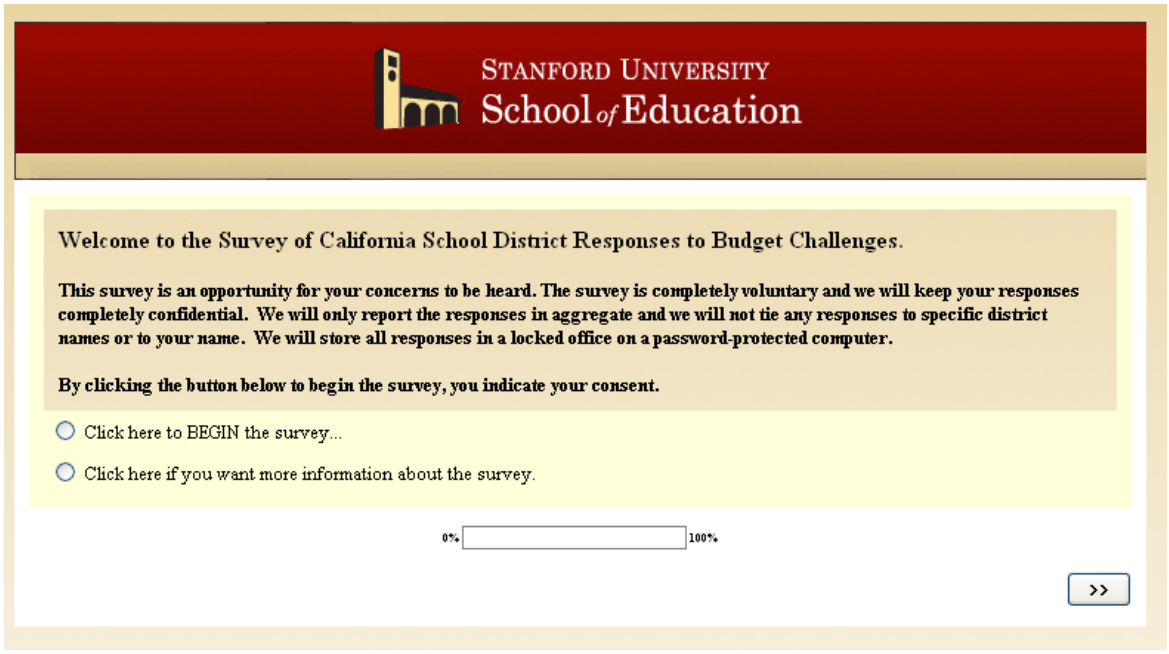
| Strata | 2006 statewide total | 2006 actual | Weight 2006 | Num districts yielded by weight06 (actual*weight) |
|---|---|---|---|---|
| Less than 1,000 | 402 | 19 | 21.158 | 402 |
| 1,000 to 4,999 | 293 | 21 | 13.952 | 293 |
| 5,000 to 9,999 | 122 | 19 | 6.421 | 122 |
| 10,000 to 19,999 | 85 | 24 | 3.542 | 85 |
| 20,000 to 30,000 | 41 | 28 | 1.464 | 41 |
| More than 30,000 | 35 | 24 | 1.458 | 35 |
| Totals | 978 | | | 978 |
| | | | | |
| | | | | |
| Strata | 2010 statewide | 2010 actual | Weight 2010 | Num districts yielded by weight10 (actual*weight) |
| Less than 1,000 | 389 | 11 | 35.364 | 389 |
| 1,000 to 4,999 | 294 | 19 | 15.474 | 294 |
| 5,000 to 9,999 | 114 | 9 | 12.667 | 114 |
| 10,000 to 19,999 | 83 | 8 | 10.375 | 83 |
| 20,000 to 30,000 | 43 | 13 | 3.308 | 43 |
| More than 30,000 | 34 | 8 | 4.250 | 34 |
| Totals | 957 | 68 | | 957 |

The 2010 weighting structure gives small districts nearly nine times more weight than large districts. This is somewhat reasonable, given that there are 11 times as many small districts in the state as large districts. However, the 2006 weighting structure gives small districts 20 times the weight of large districts.

The primary limitation for inference is that a population-based weighting structure assumes homogeneity across strata. This is a strong assumption. Districts were purposively sampled within and across strata. And given the prior expectation that small districts will make different spending decisions in response to shrinking revenues than larger districts might, it is difficult for the assumption to hold. In addition, the 2006 sample also had districts selected within each strata for reasons of fiscal health, not just population. If I cannot satisfy the assumption of homogeneity, then it seems that weighting is not necessarily a robust solution for representativeness.

## APPENDIX A3.2.

## WEB-BASED SURVEY INSTRUMENT RELEASED IN JULY 2010.



**Information Sheet**

**Study Title: School District Responses to Local and State Budget Challenges in California**

**Protocol Director: Susanna Loeb, Stanford University Professor and Director of the Institute for Research on Education Policy and Practice**

**Description: You are invited to participate in a survey exploring your school district's finances. Our goal is to better understand the budgeting and financial planning practices and challenges facing chief financial officers. This questionnaire asks about your job history, how your job has changed over the past few years, and how state and local finances are affecting your district's efforts to stabilize revenues and spending. Some portions of this survey previously appeared on a survey you may have participated in during 2006, as part of the "Getting Down to Facts" project requested by the Governor's Committee on Education Excellence. We are interested in tracking responses to those questions over time.**

**Background on the sponsor: This survey of district chief financial officers and school business officials is being conducted under the sponsorship of the Institute for Research in Educational Policy and Practice at the Stanford University School of Education. The institute initiates research projects focused on education policy challenges in finance, governance and teacher and principal labor markets. This survey operates in connection with a broader, ongoing project investigating school leadership practices in multiple school districts around the country.**

**Time Involvement: Filling out this online survey will take about 15-20 minutes and is completely voluntary.**

**Risks and Benefits: The survey results will be kept strictly confidential. While it is not anonymous, responses will be identified by district code only, analyzed by the project directors only, used only for the purposes of this study, and reported only in summary form (no individual or district-specific identifiers). The data will be stored on a password-protected computer hard disk in a locked office at Stanford. No individuals will ever be identified in written work related to this survey. The benefits you can reasonably expect to result from this study include a summary report at the conclusion of the analysis and the opportunity to learn from other districts' practices and strategies. You will also be invited to a conference where the survey results will be discussed.**

**Payments: We are providing a weblink for a $5 gift card you can redeem at amazon.com. The weblink is in your initial email invitation.**

**Subject's Rights: If you have read this form and have decided to participate in this discussion, please understand your participation is voluntary and you have the right to withdraw your consent or discontinue participation at any time without penalty. The alternative is to not participate. You have the right to refuse to answer particular questions.**

**Contact information: If you have questions, concerns or complaints about this research, its procedures, risks and benefits, contact the Protocol Director, Susanna Loeb (sloeb@stanford.edu) or Rekha Balu (rbalu@stanford.edu), or the Administrative Panels Office, Stanford University, Stanford, CA (USA) 94305-5401, or by phone: (650) 723-2480 (you may call collect).**

**Consent: Beginning the survey indicates your consent to participate in this survey, and for the data to be analyzed by researchers without identifying individuals.**

○ Click here to BEGIN the survey...

---

**INSTRUCTIONS**

**Please answer the questions that follow as honestly and completely as possible. There are no right or wrong answers. If you cannot recall the details of a decision, answer what you do recall and move on to the next question.**

**For the rest of the survey, we use "CFO" to indicate Chief Financial Officer, Chief Business Officer or other titles for the primary business and finance manager in the district.**

0% 100%

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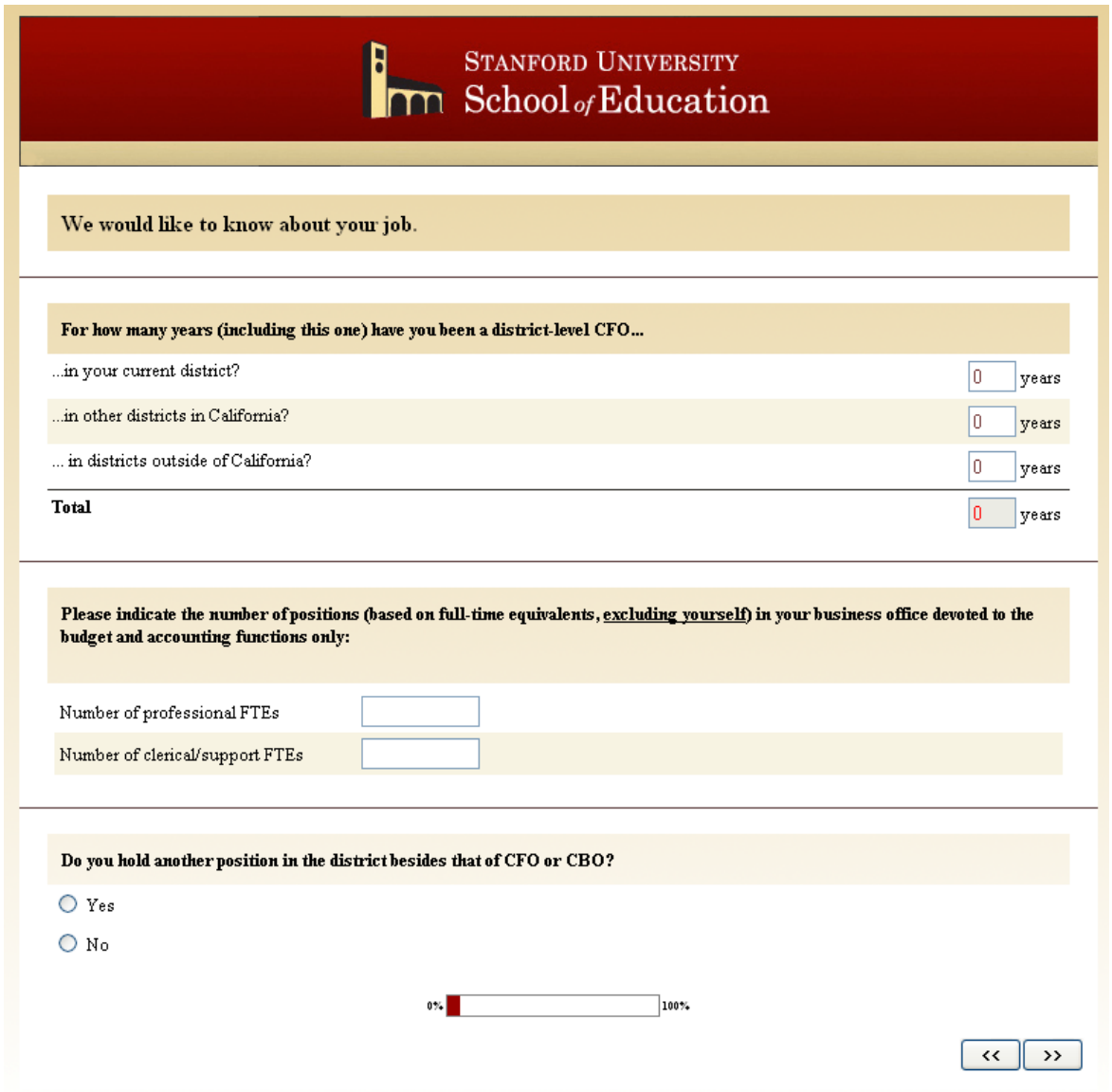


STANFORD UNIVERSITY
School of Education

We would like to know about your job.

**For how many years (including this one) have you been a district-level CFO...**

| | |
|---|---|
| ...in your current district? | 0 years |
| ...in other districts in California? | 0 years |
| ... in districts outside of California? | 0 years |
| **Total** | 0 years |

**Please indicate the number of positions (based on full-time equivalents, excluding yourself) in your business office devoted to the budget and accounting functions only:**

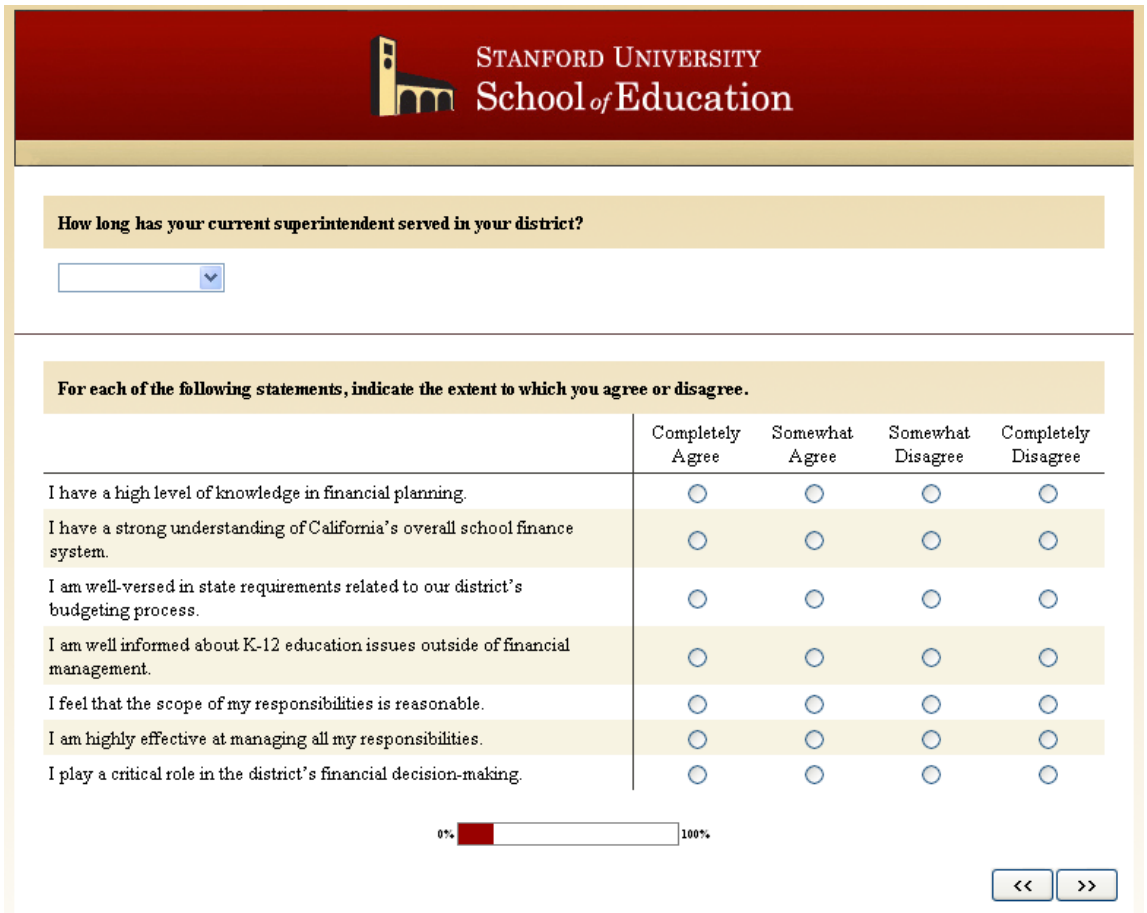
| | |
|---|---|
| Number of professional FTEs | |
| Number of clerical/support FTEs | |

**Do you hold another position in the district besides that of CFO or CBO?**

- Yes
- No

0% 100%

<< >>



STANFORD UNIVERSITY
School of Education

**How long has your current superintendent served in your district?**

**For each of the following statements, indicate the extent to which you agree or disagree.**

| | Completely Agree | Somewhat Agree | Somewhat Disagree | Completely Disagree |
|---|---|---|---|---|
| I have a high level of knowledge in financial planning. | | | | |
| I have a strong understanding of California's overall school finance system. | | | | |
| I am well-versed in state requirements related to our district's budgeting process. | | | | |
| I am well informed about K-12 education issues outside of financial management. | | | | |
| I feel that the scope of my responsibilities is reasonable. | | | | |
| I am highly effective at managing all my responsibilities. | | | | |
| I play a critical role in the district's financial decision-making. | | | | |

0% 100%

<< >>

## FINANCIAL MANAGEMENT

**How important is each of the following factors for your district to be in good fiscal health?**

| | Essential | Very Important | Somewhat Important | Not Important |
|---|---|---|---|---|
| Revenue contributions from the community | ○ | ○ | ○ | ○ |
| District's ability to raise local revenues through taxes | ○ | ○ | ○ | ○ |
| Cost controls related to salaries | ○ | ○ | ○ | ○ |
| Cost controls related to employee benefits | ○ | ○ | ○ | ○ |
| Cost controls outside of personnel | ○ | ○ | ○ | ○ |
| Predictable state funding from year to year | ○ | ○ | ○ | ○ |
| No mid-year budget cuts from the state | ○ | ○ | ○ | ○ |
| Reserve fund greater than state requirement | ○ | ○ | ○ | ○ |

**Of the factors listed above, which one is the MOST essential?**

**How important is each of the following leadership factors for your district to be in good fiscal health?**

| | Essential | Very Important | Somewhat Important | Not Important |
|---|---|---|---|---|
| Stability in district leadership | ○ | ○ | ○ | ○ |
| Stability in central office budget and finance staff | ○ | ○ | ○ | ○ |
| Stability in school principals and site managers | ○ | ○ | ○ | ○ |

**Of the factors listed above, which one is the MOST essential?**

## REVENUES

**How much do the following STATE policies contribute to unstable revenues in your district?**

| | To a great extent | To a good extent | A little | Not at all |
|---|---|---|---|---|
| Reserve fund requirements | ○ | ○ | ○ | ○ |
| State deferral of reserves across fiscal years | ○ | ○ | ○ | ○ |
| Limits on increasing local taxes | ○ | ○ | ○ | ○ |
| Restricted-use funds | ○ | ○ | ○ | ○ |
| Use of sales and income tax to fund education | ○ | ○ | ○ | ○ |
| Requirement of no unfunded mandates | ○ | ○ | ○ | ○ |
| Referendum process | ○ | ○ | ○ | ○ |

**For what purposes is your district using FEDERAL stimulus (ARRA) funds? (check all that apply)**

- ☐ To purchase or upgrade technology items (for the classroom or school)
- ☐ To maintain teaching positions
- ☐ To reduce class size
- ☐ To help spread staff reductions over multiple years
- ☐ To support new instructional programs
- ☐ To support art, music or other non-academic programs
- ☐ Other

**Is your Local Education Agency currently trying to generate additional LOCAL revenues for K-12 education spending for 2010-2011?**

- ○ Yes
- ○ No

**What is your LEA currently doing to generate LOCAL revenues? (check all that apply)**

- ☐ Trying to pass a parcel tax
- ☐ Placing a bond measure on the upcoming ballot
- ☐ Soliciting grants from private donors on an ad-hoc basis
- ☐ Establishing an education foundation
- ☐ Other

---

**Do you expect to receive PRIVATE contributions from any of these sources in FY2010-2011? (check all that apply)**

- ☐ Private foundations (e.g., Gates, Packard)
- ☐ Local education fund or foundation
- ☐ Local business partnerships
- ☐ Other
- ☐ None

---

**What is the level of your Local Education Agency's cash reserves as a percentage of the General Fund?**

0% 100%

<< >>

## FY2010-2011 BUDGET

**With whom did you meet to inform budget planning for FY2010-2011? (check all that apply)**

- ☐ No one else
- ☐ My Superintendent
- ☐ My Staff
- ☐ School principals
- ☐ Teachers Union
- ☐ County assessor
- ☐ State Department of Finance representatives
- ☐ State Department of Education representatives
- ☐ Board members (at a publicly scheduled budget meeting)
- ☐ Board members (NOT at a publicly scheduled meeting)
- ☐ District lobbyist
- ☐ Parent-Teacher Association
- ☐ Community associations
- ☐ Other

**Please describe the extent of overall budget changes to the general fund in your district:**

| | Increasing 2% or more | Increasing 0.5%-2% | Not changing | Cut 2% or less | Cut 3%-5% | Cut 6%-8% | Cut more than 9% |
|---|---|---|---|---|---|---|---|
| Compared to FY2008-2009, the budget for FY2009-2010 was... | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| Compared to FY2009-2010, the budget for FY2010-2011 will likely be... | ○ | ○ | ○ | ○ | ○ | ○ | ○ |

**Did your board approve any cost-cutting measures for the FY2010-2011 budget?**

- ○ Yes
- ○ No

0% 100%

<< >>

**Which of the following cost-cutting measures did your board approve for the FY2010-2011 budget?**

| | Approved | Not Approved | Not Considered |
|---|---|---|---|
| Jointly offer certain classes with another district | ○ | ○ | ○ |
| Eliminate some transportation routes | ○ | ○ | ○ |
| Cut paid teacher days in the year | ○ | ○ | ○ |
| Offer early retirements to teachers | ○ | ○ | ○ |
| Cut administrative staff | ○ | ○ | ○ |
| Increase class size | ○ | ○ | ○ |
| Jointly purchase vendor services with other districts | ○ | ○ | ○ |
| Job sharing among non-teaching staff | ○ | ○ | ○ |
| Cut teaching staff | ○ | ○ | ○ |
| Close schools | ○ | ○ | ○ |
| Cut classified staff | ○ | ○ | ○ |
| Other | ○ | ○ | ○ |
| Other (2) | ○ | ○ | ○ |

0% 100%

<< >>

## PERSONNEL

**How much do you agree with the following statements about possible budget cuts for FY2010-2011?**

| | Strongly Agree | Agree | Disagree | Strongly Disagree |
|---|---|---|---|---|
| The primary teachers union in my district is willing to consider a salary freeze for its members in order to prevent layoffs. | ○ | ○ | ○ | ○ |
| Budget cuts may force the district to lay off high quality teachers because they are less senior than others. | ○ | ○ | ○ | ○ |
| Good teachers may leave my district because they're concerned about the effect of budget cuts. | ○ | ○ | ○ | ○ |
| Budget cuts may force principals to lay off teacher(s) they want to keep in their schools. | ○ | ○ | ○ | ○ |
| Budget cuts give administrators the opportunity to remove poorly performing teachers. | ○ | ○ | ○ | ○ |

**For each category below, what proportion of your staff has received pink slips for FY2010-2011?**

| | 0% | 1-3% | 4-6% | 7-9% | 10-19% | 20% or more |
|---|---|---|---|---|---|---|
| Non-instructional, non-certified staff | ○ | ○ | ○ | ○ | ○ | ○ |
| Administrators | ○ | ○ | ○ | ○ | ○ | ○ |
| Instructional aides and teaching support staff | ○ | ○ | ○ | ○ | ○ | ○ |
| Certified teachers | ○ | ○ | ○ | ○ | ○ | ○ |

**How many employees do you anticipate the district will lay off in FY2010-2011? (Please write a NUMBER in the box for each category)?**

| | |
|---|---|
| Certified Teachers | |
| Other Certified Staff | |
| Administrators | |
| Non-certified staff | |
| No layoffs anticipated in any category (if true, please enter 0 or yes) | |

**Please indicate how many staff days may be cut in your district in FY2010-2011:**

| | |
|---|---|
| Instruction days: | |
| Staff development days: | |
| Non-teaching staff days: | |

**Has your district been negotiating a NEW contract with your primary teachers' union for FY2010-2011?**

Yes ○ No ○

0% 100%

<< >>

**Will the current contract you are negotiating with this union include...**

- ○ A salary increase greater than the state COLA?
- ○ A salary increase less than the state COLA?
- ○ A salary increase equal to the state COLA?
- ○ A salary freeze?
- ○ A rollback of prior salary agreements?

**Will the current contract you are negotiating with this union include a hard cap on the per-employee cost of health and welfare benefits?**

- ○ Yes
- ○ No

**Do you think that the relationship between your district and your primary teachers' union has changed since FY2007-08?**

- ○ Yes
- ○ No

0% 100%

<< >>

**How has this relationship between your district and the teachers' union changed?**

0% 100%

<< >>

**Do you think that the budget planning and allocation process has changed in your district since FY2007-08?**

- (•) Yes
- ( ) No

0% 100%

<< >>

**In which of these ways has the planning and decision-making process most changed? (choose one)**

- ( ) More SITE-BASED budgeting strategies
- ( ) More centralized budgeting driven by the CENTRAL OFFICE
- ( ) More centralized budgeting driven by the SCHOOL BOARD
- ( ) None of these

**What other changes has your district made to the budget planning and allocation process since FY2007-08?**

0% 100%

<< >>

## DISTRICT ENROLLMENT

**How important is it for you to understand each of the following factors to estimate enrollment accurately?**

| | Essential | Very Important | Somewhat Important | Not Important |
|---|---|---|---|---|
| Enrollments at charter and private schools in the district's catchment area | ○ | ○ | ○ | ○ |
| Employment trends in the metropolitan area | ○ | ○ | ○ | ○ |
| Housing trends in the metropolitan area | ○ | ○ | ○ | ○ |
| Percentage of students from low-income families | ○ | ○ | ○ | ○ |
| School-level performance as measured by state tests | ○ | ○ | ○ | ○ |
| Migration in and out of the metropolitan area | ○ | ○ | ○ | ○ |
| Statistical models, such as cohort survival | ○ | ○ | ○ | ○ |
| Other | ○ | ○ | ○ | ○ |

**Of the above items, what is the MOST important factor...**

...to estimate enrollment? [ ]

...to project teaching staff requirements? [ ]

**Of the above items, what is the MOST important factor...**

...to estimate enrollment?

...to project teaching staff requirements?

**Since the 2007-2008 school year, on average have your enrollment predictions been ... ?**

- 0-1% off
- 2% off
- 3-5% off
- 6- 7% off
- More than 7% off

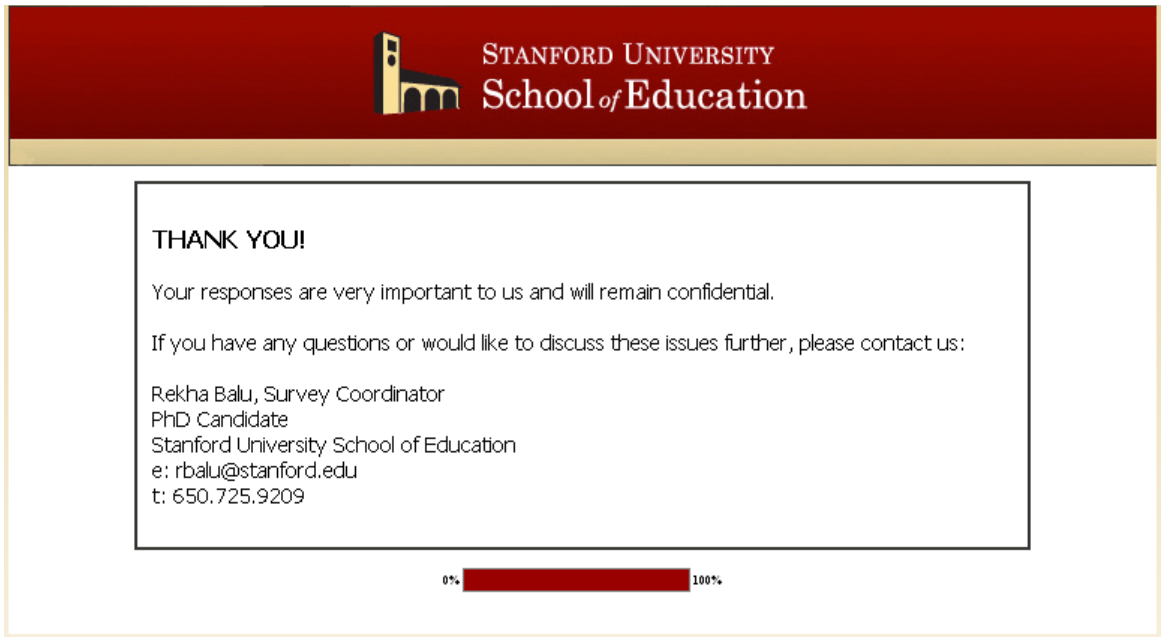
**For 2010-2011, please describe the extent of anticipated enrollment changes for the following student populations in your district:**

| | Decline more than 5% | Decline 1-5% | Stay about the same | Increase 1-5% | Increase more than 5% |
|---|---|---|---|---|---|
| Overall student enrollment will... | | | | | |
| Students participating in the Free and Reduced Lunch program will... | | | | | |
| Special education students with IEPs will... | | | | | |
| Homeless students will... | | | | | |
| English-language learners will... | | | | | |

**Since July 2009, how often have you been asked to take a survey about your district's finances?**

0% 100%

<< >>


STANFORD UNIVERSITY
School of Education
THANK YOU!
Your responses are very important to us and will remain confidential.
If you have any questions or would like to discuss these issues further, please contact us:
Rekha Balu, Survey Coordinator
PhD Candidate
Stanford University School of Education
e: rbalu@stanford.edu
t: 650.725.9209
0%
100%

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