Department of Economics

Working Paper

The Great Recession and Public Education

By

William N. Evans

Robert M. Schwab

Kathryn L. Wagner

Working Paper 2017-02

College of Business Administration

MARQUETTE
UNIVERSITY

The Great Recession and Public Education

William N. Evans
Department of Economics
University of Notre Dame
Notre Dame, IN 46530
Wevans1@nd.edu
574-631-7039

Robert M. Schwab
Department of
Economics
University of Maryland
College Park, MD 20742
schwab@econ.umd.edu
301-405-3487

Kathryn L. Wagner
Department of Economics
College of Business Admin.
Marquette University
Milwaukee, WI 53201
kathryn.l.wagner@marquette.edu
414-288-3409

January 2017

Abstract

We examine the impact of the Great Recession on K-12 education finance and employment and generate five key results. First, nearly 300,000 school employees lost their jobs. Second, schools that were heavily dependent financially on state governments were particularly vulnerable to the recession. Third local revenues from the property tax actually increased during the recession, primarily because millage rates rose in response to declining property values. Fourth, inequality in school spending rose sharply during the Great Recession. Fifth, the federal government's efforts to shield education from some of the worst effects of the recession achieved their major goal.

JEL Classification I22, I24, and I28

I.   Introduction

The recession that began in December, 2007 was the most severe economic downturn in the

United States since the Great Depression. The unemployment rate reached 10 percent in October,

2009.[1] Over eight million private sector jobs were lost and private employment did not return to

pre-recession levels until spring 2014.[2] As late as April of 2016, there were over two million long-

term unemployed people in the United States.[3,4] Analysts often call this period the Great Recession,

a term that is well-deserved.

Our goal in this paper is to outline the impact of the recession on public school finance and

to learn what we can about how to shield schools and their students from the worst effects of any

future recessions. Five major themes emerge from our work. First, the impact of the Great

Recession was unprecedented. Nearly 300,000 teachers and other school personnel lost their jobs.

All of the aggregate gains that were made in reducing class size during the 13 years before the

recession were wiped out. It took five years for state and local revenues to return to the pre-

recession levels but school districts continue to lose employees.

Second, schools that were heavily dependent on funds from state governments were

particularly vulnerable to the recession. Over the past 40 years, there has been a marked shift

toward state-financed public schools. We show that revenues from the major state taxes – the

income tax and the sales tax – fell sharply over the recession. Our results suggest that an unintended

side effect of these efforts has been to make K-12 education more vulnerable to recessions.

Third, despite the fact that the recession occurred at a time when property values were

plummeting, property tax revenue – the mainstay of local school finance – actually rose over the

---

[1] https://research.stlouisfed.org/fred2/series/UNRATE
[2] https://research.stlouisfed.org/fred2/series/PAYEMS
[3] http://www.bls.gov/news.release/empsit.t12.htm
[4] The U.S. Bureau of Labor Statistics classifies someone as long-term unemployed if they have been unemployed for at least 27 weeks.

course of the recession. We show that many school districts were able to offset the shrinking property tax base by raising the property tax rate. Property tax rates decline relatively little when property values increase and increase markedly when values decline, meaning the property tax is a stable source of revenue.

Fourth, inequality in school spending rose dramatically during the Great Recession. We argue, however, that we need to be very cautious interpreting this result. School spending inequality has risen steadily since 2000; the trend in inequality we see in the 2008-13 period is very similar to the trend we see in the 2000-08 period. It is clear that the gap in spending between wealthy and poor schools rose during the recession; the role of the recession itself is much less clear.

Fifth, we argue that the federal government's efforts to shield education from some of the worst effects of the Great Recession achieved their major goal. The State Fiscal Stabilization Fund (SFSF), created under the American Recovery and Reinvestment Act of 2009, provided $53.6 billion of funding for public schools during the early parts of the recession. We find that as a result of SFSF money, school spending was flat during the 2008-09 and 2009-10 school years.

The rest of the paper has the following organization. In Section II we use aggregate data to focus on the impact of the Great Recession on education at the national level. Initially in that section we present a brief overview of the structure of education finance in the US. We then look at the effect of the recession on state and local government revenue, employment in public schools, and school spending. We compare the impact of the most recent recession to past recessions. In Section III we turn to an analysis of state and school district-level data. Our goal in that section is to better understand how the recession affected different types of schools. So, for example, we ask if the structure of school finance was an important determinant of the impact of the recession. We continue our analysis of school districts in Section IV. In that part of the paper we look at inequality in school spending from 1972 through 2013. An important question here is whether the recession

had a particularly severe effect on schools that served children from low-income families. In Section V we look at the efficacy of the federal government's efforts to offset at least part of the effect of the Great Recession on public education. Section VI includes a brief summary and conclusions.

II.   The Effect of the Great Recession on Education at the National Level

In this section, we present estimates of education finance, spending, and employment at the national level over the great recession. As we show later in this section, the impact of the great recession was in part a function of the way education finance has evolved over time. To set the stage for this discussion, we initially present some basic facts about K-12 education finance.

A.   Some Basics of K-12 Education Finance

Annual real education spending per student nearly tripled between the 1970/71 and the 2012/13 school years.[5] Education spending, however, is sensitive to the business cycle. Figure 1 makes this point clear. That figure shows the de-trended residuals of real per student current expenditures versus the national unemployment rate.[6] The graph shows a strong negative relationship between these two series except for the mid-1990s.[7] Given this pattern, it is not a surprise to find a large drop in real current expenditures at the start of the Great Recession.

There have been some significant changes in the way schools are financed in the US over the last 40 years. In Figure 2 we summarize the distribution of education revenues by source over time.[8] State governments now play a much larger role in education finance than they once did. In the early

---

[5] Unless otherwise noted, years here are fiscal years. A fiscal year corresponds roughly to an academic year and so, for example, fiscal 1969 is roughly the 1968 – 69 academic year. Current expenditure includes salaries, employee benefits, purchased professional and technical services, purchased property and other services, and supplies. It also includes gross school system expenditure for instruction, support services, and noninstructional functions. It excludes expenditure for debt service, capital outlay, and reimbursement to other governments (including other school systems).
[6] http://research.stlouisfed.org/fred2/series/UNRATE/.
[7] In the United States, the unofficial beginning and ending dates of national recessions have been defined by the National Bureau of Economic Research (NBER). The NBER defines a recession as "a significant decline in economic activity spread across the economy, lasting more than a few months, normally visible in real gross domestic product (GDP), real income, employment, industrial production, and wholesale-retail sales."
[8] Data is taken from http://nces.ed.gov/programs/digest/d12/tables/dt12_202.asp and http://nces.ed.gov/programs/digest/d13/tables/dt13_235.10.asp.

part of the 20th century, nearly 80 percent of the revenues for public education came from local governments.[9] As Figure 2 demonstrates, in 1970 local governments provided 52.4 percent of K-12 revenues, while the state share was less than 40 percent. By 2008 the local share had fallen to 43.5 while the state share had risen to 48.3 percent.

The growing role of the states in education is in part a response to a long series of court cases that have challenged the constitutionality of an education finance system that has led to wide disparities in education spending across school districts.[10] *Serrano I* in 1971 and subsequent cases led to a requirement of equal spending per student in California. More recent cases have been driven by concerns over the adequacy of funding for public education, in particular the funding of education for students from disadvantaged backgrounds. At last count, litigants had challenged the constitutionality of state school finance systems in 45 states (Corcoran and Evans, 2015). In most cases, a decision by a high court to overturn a state education financing system has been accompanied by a direct order to make fundamental changes to school funding formulas. State legislatures have also initiated their own far-reaching reforms to school finance systems in the wake of unsuccessful litigation (e.g., Georgia and Idaho), under the threat of litigation (e.g., Missouri and Oklahoma; see Minorini and Sugarman, 1999), or in response to political pressure (e.g., Michigan).

Historically, the federal government has played a small role in K-12 education finance. The average federal share over the 1970-2008 period was 7.8 percent. The federal government did provide significant additional funding at the start of the Great Recession in response to falling state and local tax revenues. As a consequence, in 2010 the federal share of education spending reached 13.0 percent. In the last several years the federal role has move back toward historical levels. We

---

[9] http://nces.ed.gov/pubs93/93442.pdf
[10] This literature is captured in a number of papers including, Evans, Murray and Schwab (1997), Murray, Evans and Schwab (1998), Hoxby (2001), Card and Payne (2002), Figlio, Husted and Kenny (2004), and more recently, Jackson, Johnson and Persico (2016).

examine the federal government's response to the Great Recession in a later section of the paper.

It is important to look at how state and local governments are funded given their essential role in education finance. In Table 1 we report revenues to state and local governments from broad sources in 2012.[11] In the first two columns we show the tax type and the tax source; in the next two columns we report total revenues by type and the fraction of these total state revenues from this tax. We then present the same information for local governments, and then data for these two levels combined in the next four columns.

There is significant variation in state tax structures. Seven states have no income tax (and two others tax only dividend and interest income); five states do not have a sales tax.[12] Despite this heterogeneity, the income and sales are clearly the key sources of revenue for the states. Averaging across all states, 42 percent of state government revenues come from individual and corporate income taxes and an additional 37 percent comes from various sales taxes. Less than two percent of state revenues come from property taxes. We find a very different picture at the local level. The property tax generates about 59 percent of local government tax revenue while sales and income taxes produce about one fifth of total revenues. Given these facts, one might expect then that the collapse of the housing markets at the start of the Great Recession might have had a particularly severe impact on schools. We consider this issue in the next section of the paper.

B.   *The Impact of the Great Recession on the Financing of Public K-12 Education*

This section of the paper focuses on the effects of the Great Recession on the financing of public K-12 education.[13] The impact of the Great Recession on state and local tax revenues was dramatic. In Figure 3, we present a four-quarter moving average index of state and local tax revenue

---

[11] https://www.census.gov/govs/qtax/.

[12] Information about state tax policies can be found at http://taxfoundation.org.

[13] See Gordon (2012) for a further analysis of the impact of the Great Recession on state and local government finance.

from the four largest sources of revenues (property taxes, income taxes, sales taxes and corporate income taxes).[14] We present data for the most recent recession (which began in the fourth quarter of 2007) and the two previous recessions (which began in the third quarter of 1990 and the first quarter of 2001). We use the GDP implicit price deflator to generate real values; we use a four-quarter moving average because of very large within fiscal year variation in quarterly revenues, and in all cases we set revenues equal to 100 at the start of a particular recession. The horizontal axis shows the number of quarters after the start of the recession.

Figure 3 shows that the effect of the Great Recession on state and local tax revenue was unprecedented. State and local revenues were constant for about a year after the start of the recession but then quickly fell by about five percent. Revenues remained flat for five quarters and then rose very slowly. It was not until 18 quarters after the start of the recession that state and local tax revenues returned to pre-recession levels. But of course the demand for state and local government services was far from flat during this period. For example, Medicaid roles grew by 11.8 million people – an increase of 28 percent – between 2007 and 2012.[15]

We see a very different story when we look at previous recessions. Revenues never fell during the 1990 recession. Real revenues were eight percent higher 11 quarters after the start of the recession and then remained flat for the next four quarters. In the 2001 recession revenues fell for nine quarters then increased dramatically. As we will say many times in this paper, the impact of the Great Recession was very different from previous recessions.

Figure 4 looks at the time path of an index of a four-quarter moving average of major sources of real state and local tax revenues following the start of the Great Recession. All of the indexes are set to 100 in month zero which is the 4th quarter of 2007 (2007:4). Some of the lessons

---

[14] http://www.census.gov/govs/qtax/
[15] http://kff.org/other/state-indicator/monthly-medicaid-enrollment-in-thousands-june/

from Figure 4 are not surprising. Revenues from state and local income taxes, sales taxes, and corporate income taxes all fell very sharply at the start of the recession. Individual income tax collections were down 16 percent eight quarters into the recession and remained 10 percent below pre-recession levels for 13 quarters. Income tax revenues were still three percent below the levels in 2007: 20 quarter later. Sales tax revenues declined more slowly than income tax revenues but these revenues were 15 percent below the 2007 levels 15 months later. Revenues from corporate income taxes reach a nadir 11 quarters after the start of the recession and were down 28 percent. Corporate income and sales taxes were still lower by 25 and 10 percent, respectively, five years after the fourth quarter of 2007.

Property taxes followed a very different pattern. As Figure 4 shows, revenues from property taxes actually grew steadily during the first two years of the recession. They then fell slightly but remained 10 percent above pre-recession levels through the end of 2012. This is in some ways a surprising result. The housing market collapse was a key element of the Great Recession. The Case-Shiller Home Price Index, a leading measure of housing prices, suggests that the housing bubble began to deflate at least two years before the recession.[16] By the fourth quarter of 2007 the average price of a home was 20 percent below its 2005 peak. Prices continued to fall during the first year of the recession and by December 2008 the real price of a home was roughly one-third below its peak. New home starts fell from a seasonally adjusted rate of nearly 2.3 million in early 2006 to a low of less than 500,000 units in December 2007. Housing starts remained below one million homes per year even five years after the start of the recession.[17] There is some debate as to what extent the housing market collapse was a cause of the recession and to what extent it was a result of the recession. But what is clear is that the magnitude of the collapse was unprecedented.

---

[16] http://us.spindices.com/indices/real-estate/sp-case-shiller-us-national-home-price-index
[17] https://www.census.gov/construction/nrc/historical_data/

We then face a puzzle. The property tax is assessed on the value of residential real property (i.e. personal real estate), commercial, business and farm real property, and in some states personal property (e.g., automobiles). Residential real property accounts for approximately 60 percent of taxable assessments and is the largest component of the tax base by a significant margin; commercial, industrial and farm property account for around 30 percent and personal property accounts for less than 10 percent.[18] It is therefore difficult to square two seemingly inconsistent results: the property tax fared much better than other state and local taxes during the Great Recession even though a key part of the property tax base (the housing market) collapsed.

Several papers have looked at this puzzle. Lutz, Molloy, and Shan (2011) reach three conclusions. First, there is significant heterogeneity across states in their experience of the housing cycle, the institutional features of their property tax assessment and collection practice, and their responses to the housing downturn. Second, assessed values lag market values in many states, which helped to support property tax revenues when house prices fall. Third, when assessed values do catch up with market values, local officials appear to be willing to at least partially offset the decreases in assessed values with increases in tax rates.

Alm, Buschman, and Sjoquist (2011) used data from the U.S. Census Bureau Quarterly Summary of State and Local Government Tax Revenue to demonstrate that many local governments avoided any budgetary impact from declining house values. They also provided evidence from school districts in Georgia that supports Lutz et al.'s argument that local governments frequently offset property tax revenue changes that would have occurred from changing house values by changing the millage rate in the opposite direction.

Ihlanfeldt (2011) focuses on the responsiveness of property tax rates to the property tax base. Property tax revenues are the product of assessed valuation and the effective property tax

---

[18] Statistics are from Lutz, Molloy, and Shan (2011).

rate.[19] If property tax rates rise at the same rate as assessed valuations fall then property tax revenues

will remain constant. So one possible explanation as to why the property tax fared well during the

recession is that local governments were able to raise property tax rates enough to offset the effect

of a shrinking tax base. Ihlanfeldt's results suggest that tax rates are adjusted in an attempt to

stabilize property tax revenues. The tax rate offset is nearly complete for counties, but less than

complete for cities. Cities therefore cut selected expenditures to keep total expenditures in line with

total revenues.

We have looked at the hypothesis that there is an asymmetric response in tax rates to

changing assessed values. The argument here is that when property values are increasing the tax rate

falls but not so much that revenues decline. In contrast, when property values are falling, millage

rates can be increased to more than offset the decline in values. To test this hypothesis, we have

collected data on assessed valuations and property tax rates for several years for all school districts in

five states: Illinois (2008-11), Washington (2009-12), Virginia (2006-11), Texas (2009-13), and

Washington (2008-12).[20] In all cases, we took the data from peak to trough in per student assessed

property values. Note that the peak varies across states, a reflection of how frequently properties are

assessed. In all cases we have real assessed values per student and property tax millage rates at the

school district level. We use these data to estimate the econometric model

(1) $\%\Delta MR_i = \alpha_0 + \alpha_1 D_i + \alpha_2 \%\Delta PVPC_i \cdot D_i + \alpha_3 \%\Delta PVPC_i \cdot (1 - D_i) + \varepsilon_i$

---

[19] Many jurisdictions subject a specified percentage of a property to the property tax; this percentage is called the assessment ratio. The effective tax rate is the product of the nominal tax rate multiplied by the assessment ratio. So, for example, if the nominal tax rate in a town is 1.5 percent (i.e., 15 mils) and the assessment ratio is 60% then the effective property tax rate is 0.9 percent.

[20] Data on local tax rates for Virginia can be found at http://www.tax.virginia.gov/site.cfm?alias=LocalTaxRates, whereas tax collections are found at http://www.tax.virginia.gov/site.cfm?alias=SalesRatioStudies. Financial data for Washington is provided on an annual basis and the data for 2012-13 school year is found here http://www.k12.wa.us/safs/PUB/FIN/1213/fs.asp. Data for Texas is available here http://www.tea.state.tx.us/index2.aspx?id=2147504614&menu_id=645&menu_id2=789. Illinois data is available here http://webprod1.isbe.net/ilearn/ASP/index.asp. The data for Ohio for tax year 2012 is available here http://www.tax.ohio.gov/tax_analysis/tax_data_series/school_district_data/publications_tds_school/SD1CY12.aspx. We should note these states were selected because we could easily retrieve the data.

where the dependent variable $\%\Delta MR_i$ is the percentage change from peak to trough in district i's property tax millage rate. We define $\%\Delta PVPC_i$ as the percentage change from peak to trough in property values per capita in a school district and we define D_i as a dummy variable that has a value of 1 if $\%\Delta PVPC_i$ is positive (i.e., D is 1 in those districts where the per student property values rose). The elasticity of the tax rate is then α_2 in districts where the tax base is rising and α_3 in districts where the tax base is falling. We are interested in three hypotheses. First, is α_2 equal to α_3? If so, then local government response to changing property base is symmetric. Second, is α_2 or α_3 equal to 0? If so, then the millage rate is unaffected by changes in the tax base. In this case property tax collections would fall at the same rate as the tax base; government would offset none of the change in the property tax base by changing the millage rate. Third, is α_2 or α_3 equal to -1? If so, then changes in the millage rate completely offset changes in the tax base. In this case property tax collections would remain constant when the base changes.

Table 2 sets out our OLS estimates of (1). We can reject the hypothesis that government response is symmetric in all five states at the five percent level. School districts are much more likely to raise the tax rate when the tax base falls than they are to lower the tax rate when property values rise. Moreover, we cannot reject the hypothesis that the effect of a rising base is 0 but we can reject the hypothesis the effect of a falling tax base is zero in all five states. Finally, we cannot reject the hypothesis that changes in the property tax rate fully offset changes in the tax base for Illinois, Virginia, and Ohio. For Washington, our estimate of α_3 is statistically smaller than -1; for Texas our estimate of α_3 is statistically greater than -1.

In all, our results strongly suggest that school districts were able to offset a declining tax base during the recession by raising the tax rate. This result has at least two important policy implications. First, all taxes are unpopular, but the property tax is often seen as one of the most unpopular of all.[21]

---

[21] See, for example, James Alm (2013) and Cabral and Hoxby (2012).

It is a highly visible tax to taxpayers because they typically pay it directly. Property tax administration is often seen as arbitrary and idiosyncratic. The tax is particularly unpopular among the elderly who often face significant tax bills but have relatively modest incomes. The tax base is typically distributed across local governments in very uneven ways, which contributes to extreme fiscal disparities across jurisdictions. But one advantage of the property tax is that it has proven to be a quite stable source of revenue. Property tax revenues in the past have been relatively insensitive to the business cycles; they do not rise quickly when the economy is robust and do not fall much during recessions. But until the Great Recession, virtually all of the evidence on the stability of the property tax came from episodes when the real estate market was fairly stable despite ups and downs of the economy as a whole. The experience during the Great Recession tells us that the stability of the property tax is a more a general result than we might have imagined. Property tax revenues continued to rise even during one of the greatest upheavals in the real estate market we have ever seen or are likely to see in the future.

Second, as we noted above, states have assumed a larger role in education finance over the last 40 years, in part as a result to equalize education resources across school districts. As we saw in Table 1, states make little use of property tax but they are a mainstay of local government revenue. And so this shift toward state funding may have an unintended side effect. It could make public education funding much more sensitive to the business cycle. We will present some further evidence on this point in section III of the paper.

C.   Employment in Public K-12 Education

We now turn to the effect of the Great Recession on the employment of teachers and other school staff. Our primary data source here is the monthly US Bureau of Labor Statistics (BLS) Current Employment Statistics which is a monthly survey of roughly 550,000 worksites that is available back to 1939. Those data allow us to track all public sector school personnel but do not

11

allow us to consider the impact of the recession on jobs for teachers separately.

Figure 5 presents an index of full-time-equivalent employment in public K-12 education, the private sector, state government, and local government outside of K-12 education for the 36 months before and 60 months after the start of the recession. We scale all four time series so that each equals 100 at the start of the recession in December, 2007. Two points are of particular interest in the figure. First, Figure 5 shows that employment in education followed a very different time path than employment in the private sector. Private sector employment fell sharply at the start of the recession; two years after the start of the recession private employment was seven percent lower than at the start. In data not shown in this graph, private employment returned to its pre-recession level by March of 2014. In sharp contrast, jobs for teachers and other school personnel increased slightly or were flat during the first two years of the recession but then fell dramatically. Employment in public schools had not returned to pre-recession level more than five years after the start of the Great Recession.

Second, the recession took a substantial toll on public education. Employment in public schools fell by 294,700 from the start of the recession until January 2013. This represents a 3.7 percent decrease in employment. Employment in K-12 schools has increased slightly in calendar year 2013, adding back only 10,000 jobs. From fall 2007 through fall 2013, public school enrollment rose by 1.6 percent,[22] and so the drop in public school employment meant that the ratio of employees (largely teachers) to students fell by 5.1 percent over this period. Pupil/teacher ratios fell from 17.4 to 16.3 between the 1989/1990 and 2003/04 school year which was a 4.5 percent decline. The recession's impact on pupil/teacher ratios wiped out 13 years of gains in this metric in just about three years.[23] The time-series of employment in K-12 education look similar to employment

---

[22] http://nces.ed.gov/programs/digest/d15/tables/dt15_203.20.asp
[23] http://nces.ed.gov/programs/digest/d13/tables/dt13_208.10.asp

in state and local governments over this period.

A second data source allows us to take an initial look at the distribution of lost jobs within public schools. Our analysis draws on data from the Common Core of Data which is an annual census of public schools and school districts. Data on employment in broad job categories for all public schools is available in the Department of Education's *Digest of Education Statistics*.[24]

In Figure 6 we present an index of fall employment from 1998 through 2013 for four broad groups of employees in public schools: teachers, teacher aids, support staff and other employees which includes district administrators, principals, librarians and guidance counselors. We set each index equal to 100 in the 2007-08 school year. As Figure 6 shows, the number of teachers rose at the slowest rate among the four groups in the education sector between 1998 and 2008: teachers increased 14 percent, support staff 17 percent, other employees 26 percent, and aids 25 percent over that year period. During the 2008-11 period, the number of teachers fell 3.7 percent compared to a decrease of just 1.4 percent for administrators. Over this period the number of teachers fell by 118,891 and the number of teacher aids fell by 23,675. Over the same period, support staff employment fell by 38,794 and other employees fell by only 6,452. Teachers represented 51 percent of employment in 2008 but were responsible for 63 percent of job loss over the first three years of the Great Recession.

Figure 7 looks at the impact of the recession on education from a different perspective. The figure compares the effects of the most recent recession on public school employment to the effects of three previous recessions. In this figure, we present an index of K-12 employment for the four recessions and we scale each time series so that employment equals 100 at the start of each recession. The horizontal axis measures months since the start of each recession. Figure 7 shows that the impact of the Great Recession on teachers and other personnel was unprecedented. In the

---

[24] http://nces.ed.gov/programs/digest/d13/tables/dt13_213.10.asp.

1990 and 2001 recessions, public school employment continued to rise steadily despite the economic downturn. In the 1981 recession, which was much more severe than the 1990 and 2001 recessions, public school employment fell for two years but then recovered fairly quickly. Five years after the 1981 recession began, public education employment was about three percent higher than at the start of the recession. But as we showed above, employment in K-12 education remained five percent below the December 2007 level 60 months after the start of the recession.

III.   The Effect of the Great Recession on Education at the State and Local Level

We now shift gears and look at the effect of the Great Recession on public education at the state and local level. Focusing on states and school districts allows us to address questions we cannot answer with national data. For example, how did the structure of school finance in a state or school district affect the impact of the recession on schools? How did inequality in school spending change during the recession?

A. School District Data

We have developed a balanced panel school district data set for this analysis. We describe the construction of our data set in an online appendix to this paper.[25] As we explain in the online appendix, we match data from the Common Core to the financial data contained in the F-33 files. Our sample consists of annual observations for 9,692 regular school districts for the 1994-95 school year through the 2013-14 school year.[26] Because of missing data, the final data set excludes many districts, mostly ones with small enrollments. As a consequence, while the data set contains only about 71 percent of all regular districts, those districts account for 88 percent of all public school

---

[25] The online appendix can be found at
http://epublications.marquette.edu/do/search/?q=author_lname%3A%22Wagner%22%20AND%20author_fname%3A%22Kathryn%22&start=0&context=507519&sort=date_desc
[26] According to NCES, regular districts include local education agencies that operate primary and secondary schools but excludes such districts as regional education service agencies, supervisory union administrative centers, state or federally operated agencies, and independent charter schools.

students.

B. Education Spending

We initially focus on one question: which schools were affected most severely by the Great Recession? The results from the last section suggest that, everything else equal, school districts that relied heavily on state funding were more vulnerable than districts that relied on support from local taxes. As we showed, states generate most of their revenues from income and sales taxes and both of these taxes fell sharply during the recession. In contrast, local governments rely primarily on property taxes and property tax revenues were fairly stable during the Great Recession.

We use our balanced panel of school districts described above to shed light on this issues. The dependent variable in this econometric work is the percent change in per student revenues for the 2006-07 and 2010-11 school years. We would like to use data on income in this analysis but income data are not available on the school district level. We therefore use the percentage change in county-level per capita income from 2007-11 constructed from the Bureau of Economic Analysis's Local Area and Personal Income and Employment Regional Data.[27] We also merge this with the change in the county unemployment rate over the 2007-11 period taken from the Bureau of Labor Statistics Local Area Unemployment Statistics.[28] In column 1 of Table 3 we regress the outcome of interest on these two variables plus the fraction of district revenues that came from state sources. In this column, we report OLS standard errors in square brackets and standard errors that allow for within-state correlation in the errors in parentheses.

Looking at the parameter estimates and the OLS standard errors, we find what we think

---

[27] Per capita income information can be downloaded from the Bureau of Economic Analysis at http://www.bea.gov/iTable/iTable.cfm?reqid=70&step=1&isuri=1&acrdn=5#reqid=70&step=25&isuri=1&7022=49&7023=7&7024=non-industry&7001=749&7029=49&7090=70.

[28] State unemployment rates are from the Bureau of Labor Statistics Local Area Unemployment Statistics and were downloaded from the Department of Agriculture's Economic Research Service at http://www.ers.usda.gov/data-products/county-level-data-sets/download-data.aspx#.U8_727FvLkg

most people would predict: expenditures/pupil fell sharply in school districts where the

unemployment rate rose or per capita income fell. The results also suggest that districts with greater

support from the state in 2006-07 experienced significantly lower growth over the next five years.

It is not clear, however, if the estimates in the first column of Table 3 capture district-level

characteristics or state-level characteristics. One piece of evidence on this question is that when we

allow an arbitrary correlation in errors within a state, the standard errors increase by a factor of five,

suggesting that there is some shock that is common to districts within states. In the second column,

we add state effects to the model and cluster the standard errors at the state level. Note that the

coefficients on change in income and state share are now no longer statistically significant and the

coefficient on the unemployment rate is actually the wrong sign. This suggests that the results in

column 1 were capturing events at the state level rather than what is happening at the district level.

In the third column we get some sense of the variables that are driving this result where we take out

the state effects and add in four variables measured at the state level: the percentage change in real

per capita income from 2007-11,[29] the change in the state unemployment rate,[30] the share of K-12

revenues provided by the state, and the change in house prices from June of 2007 to June of 2011 as

measured by the state housing price index from Freddie Mac.[31] In this model, the only two variables

that are statistically significant are the change in the state unemployment rate and the state share of

education for all districts in the state. Nationwide the unemployment rate rose from 4.6 in June of

2007 to 9.1 percent in June of 2011. From the results in column 3, a change this large at the state

level is estimated to reduce spending/student by $(0.045)(-2.64)= -0.119$ or almost 12 percent. It is

---

[29] Per capita income information at the state level can be downloaded from the Bureau of Economic Analysis at http://www.bea.gov/iTable/iTable.cfm?reqid=70&step=1&isuri=1&acrdn=5#reqid=70&step=25&isuri=1&7022=49&7023=7&7024=non-industry&7001=749&7029=49&7090=70.

[30] State unemployment rates are from the Bureau of Labor Statistics Local Area Unemployment Statistics and were downloaded from the Department of Agriculture's Economic Research Service at http://www.ers.usda.gov/data-products/county-level-data-sets/download-data.aspx#.U8_727FvLkg.

[31] This data is available for download at http://www.freddiemac.com/finance/fmhpi/.

not uncommon to see a 20 percentage point difference in the state share in K-12 revenues across states, and a change this big is estimated to reduce spending during the recession by four percent.

The results in the first three columns of Table 3 can be criticized because we do not include a measure of changes in property value at the local level. Data to construct such a measure are not available for all districts. However, the Freddie Mac housing price index is calculated at the level of the Core Based Statistical Area (CBSA).[32] In the final three columns of Table 3 we reduced the sample to the 3,692 districts that are located in CBSA's which allows us to add a local housing price index as a covariate. The basic results in this case are qualitatively the same as the full sample. We find in column (4) that there are large effects of local economic conditions on spending that seem to be proxying for state-level variables, such as state effects (column 5) or state-level economic variables (column 6).

Table 4 summarizes our econometric estimates of some of the determinants of the impact of the recession on the district-level pupil/teacher ratio. The dependent variable in those three models is the percent change in the district pupil/teacher ratio between 2007 and 2011. The models in columns (1) – (3) mirror the structure of the estimates in Table 3 where numbers in brackets represent regular OLS standard errors and the numbers in parentheses represent the standard errors clustered at the state level. Since we do not have school district level measures of unemployment and income, we use county-level aggregates for these variables.

In column (1) where we add in covariates at the county level, we see that rising income and falling unemployment rates reduce the pupil/teacher ratio. These estimates are statistically significant at conventional levels when regular OLS standard errors are used but the standard errors increase appreciably when we cluster at the state level. With either standard error, the fraction of revenues

---

[32] A CBSA includes an urban center and its suburbs. CBSA are defined by the Office of Management and Budget (OMB) and replaced the old OMB concept of a metropolitan area.

from the state is positive and statistically significant, suggesting that districts that are heavily dependent on the state saw an increase in the pupil/teacher level. In column (2), none of these results remain statistically significant when we add state fixed effects. When we take out the state effects and add in state variables in column (3), the ONLY statistically significant variable is the fraction of K-12 revenues from the state across all districts. The results are essentially unchanged when we reduce the sample to districts in metro areas. However, the percentage change in the state-level housing price index is positive.

IV. The Impact of the Recession on School Spending Inequality

In the previous sections we have focused largely on how the Great Recession altered average outcomes. Here we turn to the impact of the recession on inequality in education spending. Unlike most sectors of the economy at the end of the 20th century, which became more unequal, between-district measures of resources devoted to K-12 education actually was becoming more equal (Corcoran and Evans, 2015; Murray, Evans and Schwab, 1998). We examine whether this trend continued during the Great Recession.

A.   Data and the Measurement of Inequality

Our analysis utilizes the panel of school districts from 1993 to 2013 that we outlined above. For data prior to 1993, we use measures of inequality reported by Evans and Schwab and their various coauthors. In all, we have data for five year intervals starting in 1972 until 1992, 1990 data, and annual data from 1993 and on. As we noted above, this data set includes current expenditures per pupil from the F33 data for unified districts.

We look at four measures of inequality.[33] The Gini coefficient ranges from 0 (perfect equality) to 1 (perfect inequality) and is based on the Lorenz curve. The 95/5 ratio is the ratio of

---

[33] See Berne and Stiefel (1984) for a thorough discussion of the properties of measures of equity in public school funding.

spending for the student at the 95th percentile in district spending divided by the student at the 5th percentile in spending. The coefficient of variation equals the ratio of the standard deviation of to the mean of school spending. The Theil index has the attractive property that is can be decomposed to show the disparity in per-pupil revenues between and within states.

The four national estimates of between-district inequality are presented in Table 5. Looking at the entire 42-year period between 1972 and 2013, we see very little change overall in the inequality of school spending. This is true regardless of which measure of inequality we rely on. This overall trend, however, masks enormous differences within this time period. There are two distinct sub-periods. From 1972 to 2000 inequality fell sharply. Depending on which measure we use, inequality in school spending fell between 20 and 38 percent during that period. The US did make significant progress in an effort to reduce the disparities between rich and poor school districts.

But the trend changed dramatically in 2000. All four of our measures reversed course and rose steadily from 2000 to 2013. The increase in inequality during this 14-year period essentially undid all of the progress that was made during the preceding 29 years. And so it is somewhat misleading to say that there has been little change in inequality in school spending: we were able to reduce inequality, but the success was fleeting.

Table 5 exploits the unique properties of the Theil index of inequality and looks at the national, between-state and within-state measures of current expenditures per pupil. Both measures fell sharply from 1972 to 2000. Within-state inequality fell by 43 percent and between-state inequality fell by 36 percent in this period. There is a fair amount of evidence that the decline in inequality in school spending was at least in part the result of successful court-ordered state efforts to reduce inequality. As we argued above, there has now been litigation over school finance in virtually every state. Murray, Evans, and Schwab (1996), for example, found that court-ordered education finance reform did significantly decrease within-state inequality in spending. Depending

on the way they measured inequality, their results imply that reform in the wake of a court decision reduced spending inequality within a state by anywhere from 16 to 38 percent. Reforms reduced inequality by raising spending at the bottom of the distribution while leaving spending at the top unchanged. As a result of court-ordered reform, spending rose by 11 percent in the poorest school districts, by 7 percent in the median district, and remained roughly constant in the wealthiest districts. Finance reform led states to increase spending for education and left it unchanged in other areas. Thus, by implication, states funded the additional spending on education through higher taxes. As a consequence, the state's share of total spending rose as a result of court-ordered reform.

Rising between-state and within-state inequality both contributed to the overall increase in inequality in education spending starting in 2000. But clearly the main factor here is growing differences between the states in school spending. Between-state inequality rose by 85 percent between 2000 and 2013; within-state inequality in spending rose by 23 percent during the period. It is not clear that the Great Recession played a major role in the increase in inequality in school spending. All of our inequality measures rose at nearly the same rate between 2000 and 2008 and between 2008 and 2013. The data suggest that a combination of factors other than the effect of the Great Recession led to a continual rise in inequality in education expenditures over the 14 year period. Almost certainly the increase in income and wealth inequality in the US played a key role.

The results from Table 2 suggest an additional answer. When housing prices are increasing, the elasticity of response on the millage rate is negative but much less than 1 in absolute value. This suggests that as property values increase, tax revenues increase as well. Hence, in an era of rising property values, we would expect faster growth in per student spending in areas with faster growth in per student assessments. If the high spending states in the early 2000s were also those states with the fastest growth in property value, then this would help explain why spending in these states grew so much. We do not have per student assessments for all states over the past 14 years but we have a

reasonable proxy which is the change in housing prices over that period. In Figure 8, we graph the

percentage change in the Freddie Mac state-level house price index between 2000 and 2011 versus

the real state-level per pupil current expenditures in 2000. Note that this graph has a steep positive

slope, implying that high spending states in 2000 had the greatest increase in house prices over the

next 11 years. If the elasticity of tax rates with respect to assessed valuations is less than 1 in

absolute value when property values are increasing, (i.e., tax rates do not fall as fast as property

values rise), a result we found for five states in Table 2, this would help to explain the growth in the

between-state inequality in expenditures.

V.   The Federal Government's Response to the Great Recession

A.   The Stimulus Bill and Education Finance

President Obama signed the American Recovery and Reinvestment Act of 2009 (ARRA)

into law on February 17, 2009.[34] ARRA was a key element of the government's effort to fight the

recession that began in December 2007 and accelerated with the Lehman Brothers bankruptcy in

September 2008. The estimated cost of the bill when it was passed was $787 billion.[35] ARRA

included $237 billion in tax relief for individuals and $51 billion of tax cuts for business. The bill

provided $155.1 billion for health care (largely additional spending on Medicaid, Medicare, and

subsides for private insurance for people who were laid off from their jobs), $105.3 billion for

infrastructure investment, and $82.2 billion for extended unemployment benefits and other aid to

low income workers, the unemployed, and the elderly.

ARRA provided nearly $100 billion for education. The single largest component of the aid

to education was the State Fiscal Stabilization Fund (SFSF). SFSF was a new, one-time

appropriation of $53.6 billion. Of the amount appropriated, the U.S. Department of Education

---

[34] Pl 111-5. https://www.gpo.gov/fdsys/pkg/PLAW-111publ5/pdf/PLAW-111publ5.pdf
[35] This section draws heavily on http://www2.ed.gov/policy/gen/leg/recovery/factsheet/stabilization-fund.html

awarded governors approximately $48.6 billion by formula in exchange for a commitment to advance essential education reforms to benefit students from early learning through post-secondary education.[36] The purpose of these funds was to help stabilize state and local government budgets in order to minimize and avoid reductions in education and other essential public services. Program funds could also be used to help support the modernization and renovation of school facilities.

Four principles guided the design of the education component of ARRA. First, spend funds quickly to save and create jobs. ARRA funds were to be distributed quickly to states and districts in order to avoid layoffs. States and districts in turn were urged to move quickly to develop plans for using funds, consistent with the law's reporting and accountability requirements, and to promptly begin spending funds to help drive the nation's economic recovery. Second, improve student achievement through school improvement and reform. ARRA funds were to be used to improve student achievement, and help close the achievement gap. Third, ensure transparency, reporting and accountability. Recipients were required to publicly report on how funds were used. Finally, invest one-time ARRA funds to minimize the "funding cliff." States and districts were encouraged to use SFSF funds in ways that did not result in unsustainable commitments after the funding expired.

ARRA specified the way the funds were to be allocated to the states. Sixty-one percent of a state's allocations were based on a state's relative population of individuals aged 5 to 24, and 39 percent was based on its relative share of total population. States were required to use 81.8 percent of SFSF funds for the support of public elementary, secondary, higher education, and (as applicable) early childhood education programs and services. The states had to use their allocations to help restore FY 2009, 2010, and 2011 support for public elementary, secondary, and postsecondary

---

[36] The Department of Education was to use $5 billion of funding to make competitive grants under the "Race to the Top" fund. These grants were designed to help states make significant improvement in student achievement. The Department of Education was also authorized to spend up to $650 million to make competitive awards under the "Invest in What Works and Innovation" fund. These awards were to serve as rewards to districts and nonprofit organizations that had made significant gains in closing achievement gaps to serve as models for best practices.

education to the greater of the FY 2008 or FY 2009 level. The funds needed to restore support for elementary and secondary education had to be run through the state's primary elementary and secondary education funding formulae. If any SFSF funds remained after the state had restored state support for elementary and secondary education and higher education, the state was required to award the funds to school districts on the basis of the relative Title I shares (but not subject to Title I program requirements). States were to use the remaining 18.2 percent of their SFSF funds for education, public safety, and other government services. This could include assistance for early learning, elementary and secondary education, and to support public colleges and universities. In addition, states could use these funds for modernization, renovation, or repair of public school and public or private college facilities.

The Education Job Funds program was the second major federal effort to offset some of the effects of the Great Recession on public education.[37] The Job Funds bill was signed into law on August 10, 2010. It provided $10 billion in assistance to save or create education jobs for the 2010-2011 school year. A district that had funds remaining after the 2010-2011 school year was allowed to use those remaining funds through September 30, 2012. The Department determined the allocation for each State[38] by formula on the basis of (1) its relative population of individuals who are aged 5 to 24, and (2) its relative total population.[39] States were required to distribute Education Job Funds to school districts *either* through the State's primary elementary and secondary education funding formula(e) as identified in its application for funding under the SFSF program, *or* on the basis of the districts' relative shares of funds under Part A of Title I of the Elementary and Secondary Education Act of 1965 (ESEA) for the most recent fiscal year for which data are available.

---

[37] This section draws heavily on "Initial Guidance for the States on the Education Jobs Fund Program," U.S. Department of Education, April 15, 2011. (United States Department of Education, 2011).
[38] The amount of funding available to each State under the program is provided on the program website at http://www2.ed.gov/programs/educationjobsfund/index.html.
[39] For purposes of this program, the District of Columbia and Puerto Rico are defined as States.

There have been several efforts to evaluate the impact of SFSF and the Education Job Funds. A 2009 analysis by the Obama administration looked at state funding for K-12 and higher education for the two previous and current school years.[40] It concluded that SFSF funds restored nearly 100 percent of the 2008-09 budget gaps and a significant portion of the 2009-10 shortfalls. Based on an analysis of states' initial and preliminary submission of the first ARRA quarterly reports the study argued that over 250,000 education jobs have been retained or created through ARRA.

Rentner and Usher (2012) Center on Education Policy (CEP) study tracked the use of ARRA and Education Jobs funds and the implementation of ARRA-related reforms since these laws were enacted. These six reports were based on survey responses of state and local officials charged with implementing the ARRA and Education Jobs programs. In particular, CEP surveyed state education agency officials and governors' staff and conducted nationally representative surveys of school district officials, including superintendents, chief financial officers, and program directors. CEP came to five conclusions. First, the stimulus programs largely met their goal of stabilizing school finances. In just over half of the districts surveys, SFSF money offset all of the loss of state funding in FY 2010. Virtually all of the remaining districts said the funds offset at least part of the lost state funds. Second, 69 percent of the districts reported that they used SFSF funding to save or create jobs for teachers and other school personnel. Third, to make up for funding shortfalls not covered by ARRA funds, 85 percent of the districts that lost funds responded by cutting jobs for teachers and other school personnel. Fourth, about two-thirds of the administrators said their spending choices were influenced to a great extent by the one-time nature of the resources. Finally, to comply with the ARRA reform assurances, the vast majority of states surveyed undertook a variety of strategies to implement rigorous standards and assessments and statewide longitudinal data systems. A majority of survey states also took steps to tie teacher and principal evaluations to

---

[40] See http://www.whitehouse.gov/assets/documents/DPC_Education_Report.pdf

student achievement and provide various supports to low-performing schools. Fewer states, however, undertook other reforms related to teacher effectiveness or low-performing schools, such as adopting incentives to attract highly qualified teachers and principals to struggling schools.

B.   *The Distribution of Stimulus Funds*

To begin an analysis of how the stimulus impacted schools, we first merged data on stimulus payments to schools from the recovery.gov data base to data from the Common Core and F33 outlined above. Unfortunately, this was a difficult exercise because the primary identification used in the recovery.gov data set was the Duns number which is not reported in NCES data sets. To match the data, we first selected grants for K-12 education based on the Catalog of Federal Domestic Assistance (CDFA) number, then matched specific grants to recipients based on the zip code of the recipient, and then visually identified whether the name of the recipient matched the name of the district – in many districts by hand. We matched grants to the SY 2008-2009 F33 data.

A similar exercise was conducted by the Institute of Education Sciences (IES) of the Department of Education (Garrison-Mogren et al., 2012). This IES paper reports two versions of total stimulus awards: one for all LEA's and another for Districts. All LEA's includes supervisory unions, regional vocational school districts, etc. while districts are only regular schools and charter schools, which is closer to what we use in the F33 above. We therefore focus on their numbers for districts, except for Title 1 totals which are for all LEA's. The IES funding analysis ends in the fourth quarter of 2010 while ours continues to the third quarter of 2013. Our results come from stimulus funds that matched with districts in the F33 while IES results are stimulus funds that matched to SY 2008-2009 CCD.

In Table 6, we report aggregate information about the amount of grant funds we could match to school districts by grant type and we compare this to the grant amounts reported by the IES. In general, our estimates of dollar amounts are slightly higher than the values in the IES

report, mainly because we used a more recent version of the recovery.gov data. In aggregate, our numbers for the SFSF grants differ by less than 1 percent and across all grants by only 2.7 percent. We do however have a smaller number of districts because we match our data to the F33 instead of the Common Core. Our numbers for funds differ most for pre-school grants where we find fewer districts but we record more grant dollars. This is most likely due to the fact that our data from the recovery web page was drawn much later than the original IES document.[41]

C.   SFSF Funds and School Finance: Some Econometric Evidence

In this section, we examine the impact of SFSF funding on state funding for education. Consider a panel data set where we have state revenues per pupil over time for a sample of districts. Let $S_{ij}^t / Pupil_{ij}^t$ be the state funding per pupil in district i, in state j in year t and let $SFSF_{ij}^t / Pupil_{ij}^t$ be the corresponding values distributed through the SFSF program. We would like to estimate a simple regression of state spending per student on SFSF funding per student of the form

$$(2) \qquad S_{ij}^t / Pupil_{ij}^t = \beta_0 + SFSF_{ij}^t / Pupil_{ij}^t \beta_1 + u_{ij} + v_j^t + \varepsilon_{ij}^t$$

where u_{ij} is a district fixed effect, v_j^t is a state-specific year effect and ε_{ij}^t is a random error. If the SFSF program is working as intended, then the coefficient β_1 should be -1; that is, an additional dollar from the federal government through this program allowed states to reduce spending by exactly a dollar. In contrast, if β_1 equals 0, then SFSF had no impact on state spending.[42]

We faced two problems in estimating (2). First, the recovery.gov website records when grants were first awarded but it does not indicate when they were spent. In the case of SFSF, there is tremendous variation across states in when these funds were distributed to districts. Some states

---

[41] Our table does not include some more minor stimulus categories such as Title II technology grants, grants for school lunch equipment, Title I school improvement funds and funds for longitudinal data.
[42] Thus β_1 equal to -1 is evidence of a complete flypaper effect and β_1 equal to 0 is evidence of the absence of a flypaper effect.

such as California and Illinois spent the vast majority of funds in FY08 while other states such as Virginia reserved a significant portion of funds for distribution in FY09 and FY10. Unfortunately, we do not have a comprehensive source of data that indicates when states distributed funds to the districts. Starting in FY09, districts reported three variables in the F-33 associated with ARRA funding. One measured new Title 1 funds, the second measured capital outlays, and the third measured all funds that went to current expenditures. This third variable would include SFSF funds, but it would also include other funds such as support for special education. We use this third measure as a proxy for SFSF funds, but since this category represented 81 percent of non-capital, non-Title 1 funds, it is a quite sensible proxy.

Second, there is potential endogeneity problem in the econometric estimation. If states distributed more funds to districts with lower local revenues, then the size of SFSF awards may signal something about the underlying financial health of the local area. We believe that the way in which SFSF funds were distributed at the state and local level means that this endogeneity issue can be addressed in a straightforward two-stage least-square (2SLS) procedure.

As we noted above, the allocation of SFSF funds had two distinct steps. First, states received funds from the federal government. State allocations were determined by formula and states received a specific amount based on the size of the student population and the size of the state. Second, districts had to apply for SFSF funds. Because receipt of funds required districts to agree to some specific reforms and enhanced reporting, some districts chose not to participate in the SFSF program. Our data indicates that two percent of all school districts did not receive SFSF funds. Non-participating districts tended to be smaller than average (the average size of districts not receiving funds was 2,106 students while the corresponding number for participating districts is 4,245), have fewer poor students (78 versus 86 percent receiving Title 1) and are in rural areas (58

versus 55 percent).[43] Overall, districts NOT receiving SFSF funds represent only 1.1 percent of all students and 2.1 percent of the districts in Table 6.

In general, states distributed SFSF money in a way similar to the way they distributed other state funds. In Figure 9, we graph on the x-axis the fraction of state revenues in FY08 that went to a particular district.[44] On the y-axis, we report the fraction of a state's SFSF funds in total that went to that district. We also include the regression line that best fits these points. That line is essentially the 45 degree line. In a regression of the SFSF share from the state on the state share of total revenues in FY08, the coefficient (standard error) on this variable is 1.007 (0.013) and we cannot reject the null that this coefficient equals 1. The fact that states distributed SFSF funds in a similar way to other state revenues will be exploited in a 2SLS procedure below.

The instrument we use exploits the results in Figure 9 which suggest that once the total size of the state's SFSF grant was announced, districts had a good sense of how much they would receive from the state. Let $SFSF_j^t$ be the total SFSF funds distributed by state j in year t, let θ_{ij}^{08} be the share of state j's funds distributed to district i in FY08, and $Pupils_{ij}^t$ be the number of students from district i in year t. Our instrument for $SFSF/Pupil_{ij}^t$ is then

$$(3) \qquad INST_{ij}^t / Pupil_{ij}^t = \frac{\theta_{ij}^{08} SFSF_j^t}{Pupils_{ij}^t}.$$

In year t, district i could expect to receive $\theta_{ij}^{08} *100$ percent of total $SFSF_j^t$ funds distributed under this program in year t; dividing this by district size turns it into a per pupil amount. In this case we will use data from FY06 through FY11 which gives us three years before SFSF and three years when

[43] These numbers are based on data from the FY08 F-33 data.
[44] In this graph, we only include a 10% random sample of districts that received SFSF funds. For ease of exposition, we excluded any district that received greater than 1 percent of a state's allocation of revenues in FY08, which is a small number of districts.

all SFSF funds were supposed to be distributed. In years prior to the ARRA, $SFSF_j^t = 0$ so

$INST_{ij}^t / Pupil_{ij}^t = 0$. Because the instrument only makes sense for districts that received SFSF

funds, we delete districts that did not participate in that program. In all, our data set has information

for 9,450 districts over six years. In our 2SLS models we weight the regressions by number of pupils

and we cluster standard errors at the state level.

In the first column of Table 7, we report the first-stage estimate where we regress

$SFSF_{ij}^t / Pupil_{ij}^t$ on $INST_{ij}^t / Pupil_{ij}^t$, plus district effects and state-specific year effects. The

coefficient on the instrument is 0.88 and we can easily reject the null that the parameter equals 0.

The first-stage F-test is 66.8 so there are no concerns of finite sample bias in this case. We report

the 2SLS estimate of equation (2) in the second column of Table 7. The estimated coefficient on

$SFSF_{ij}^t / Pupil_{ij}^t$ is -0.94 with a standard error of 0.256. We can easily reject the null that the

coefficient is zero but the p-value on the null that the coefficient is -1 is 0.80. In general, the results

in Table 7 suggest the SFSF program was working as intended; for every dollar distributed to the

districts through this program, the states reduced spending by a dollar and there was no tax relief

offered to local taxpayers from these grants.

VI.   Summary and Conclusions

When we began this project we focused on a single question: how did the Great Recession

affect public schools? Our research has led to some interesting answers to this question, but it has

generated some important further questions as well. Our results strongly suggest that the growing

role of the states in public education magnified the impact of the Great Recession. Over the last 40

years, states have assumed more and more responsibility for funding public schools. This shift in

the way schools are financed is in part a result of legislative and judicial efforts to reduce the wedge

between resources in rich and poor schools. As previous work has shown, the increase in state

funding successfully reduced between-district inequality from 1972 through 2000. But this growing reliance on the states has, however, proved costly. States rely on taxes that are particularly sensitive to the ups and downs of the economy. The Great Recession led to a steep decrease in state tax revenues and consequently state support for schools. An important question we do not address is whether it is possible to have a more redistributive state system of support that does not subject districts to these large systemic shocks. Given that states will continue to rely on income and sales taxes, these goals seem incompatible.

We also found that the Great Recession had a much smaller impact on local support for education. As we argued above, this is a somewhat surprising result. The recession began with a sharp fall in housing prices. Given that most local school districts rely heavily on the property tax, one would expect that local tax revenues would have fallen at least as far as state tax revenues. This turned out not to be the case. As we showed in some of our state case studies, school districts seem to be able to raise tax millage rates to compensate for any loss in property values. In four of five states we studied, we cannot reject the null that when property values were falling, the elasticity of the millage rate with respect to per capita property values was -1. This raises an additional question: why do property tax rates rise when the tax base falls but remain unchanged when the tax base rises? The ease with which local governments can change the property tax stands in stark contrast to voter sentiment about the property tax. The American Enterprise Institute has compiled survey results from 1937 about what taxes respondents consider fair and onerous and they conclude that "surveys suggest that the local property tax is now considered more onerous than the federal income tax" (p.3). They note that the property tax is usually mentioned as the worst or least fair tax. As one example, Gallop/CNN/USA Today in April 2005 found that 42% of respondents listed the property tax as the "worst or least fair" way to tax, twice the rate of the federal tax and at least three

times the rate for state sales, Social Security or state income taxes (p.18).[45] As Cabral and Hoxby (2012) note, the property tax is one of the most salient taxes and also one of the most hated. They conclude that the high salience of the property tax explains why voters despise it so much.

Our results suggest that one reason voters hate the property tax is that local government spending always rises. The results in Table 2 point to an interesting dynamic with respect to property values. When property values per capita are increasing the elasticity of interest is much less than 1 in absolute value, indicating that total revenues/pupil will increase in those situations. Similarly, property value declines do not generate reductions in expenditures given the plasticity of the millage rate. Local revenues/pupil are almost immune from reductions.

Starting in the early 2000s, the long-term secular decline in between-district inequality reversed, and now inequality is about the same as it was in 1972. In a span of 12 years, 30-years of reductions in inequality were eliminated. This occurred well before the start of the Great Recession and hence, this trend had little to do with the recession. In fact, the available evidence suggests that Great Recession may have reduced inequality slightly.

However, it does leave open the question: why did things change so dramatically in the early 2000s? Corcoran and Evans (2010) argue that in a simple median-voter model, rising inequality due to changes in the top of the income distribution should increase public spending. With an income or wealth tax, rising inequality at the top of the distribution reduces the cost to the median voter of raising an extra dollar of revenues and hence increases spending. This is one possible mechanism but prior to this paper, no one has documented the rising inequality in between-district spending over the past decade let alone identified a possible mechanism.

Finally, the Great Recession led to the largest expansion of federal support for public education. Through ARRA, the federal government's share of school district revenue nearly

---

[45] http://www.aei.org/files/2012/04/09/-aei-public-opinion-study-on-taxes-2012_082833686158.pdf

doubled, albeit for a short period of time. The largest component of ARRA support for education came through the State Fiscal Stabilization Funds. Our results suggest that the program worked as intended: a dollar in ARRA support offset a dollar of state funding for education. Unfortunately, our results do not answer a more difficult question which is what states would have done had they not received stimulus funds.

References

Alm, James. 2013. A Convenient Truth: Property Taxes and Revenue Stability. *Cityscape*, 243-245.

Alm, James., Buschman, Robert. D., and Sjoquist, David. L. 2011. Rethinking local government reliance on the property tax. *Regional Science and Urban Economics*, *41*(4), 320-331.

Berne, Robert., and Stiefel, Leanna. 1984. *The measurement of equity in school finance: Conceptual, methodological, and empirical dimensions* (Vol. 17). Baltimore: Johns Hopkins University Press.

Cabral, Marika, and Caroline Hoxby. 2012. "The Hated Property Tax: Salience, Tax Rates and Tax Revolts." *National Bureau of Economic Research* Working Paper # 18514.

Card, David, Payne, A. Abigail, 2002. "School finance reform, the distribution of school spending, and the distribution of student test scores." Journal of Public Economics 83(1), 49-82.

Corcoran, Sean, and William N. Evans. 2010. "Income Inequality, the Median Voter, and the Support for Public Education." *National Bureau of Economic Research* Working Paper # 16097.

Corcoran, Sean, and William N. Evans. 2015. "Equity, Adequacy and the Evolving State Role in Education Finance." In *Handbook of Research on Education Finance and Policy*, eds. Helen F. Ladd and Margaret Goertz, Routledge.

Evans, William N., Sheila E. Murray, and Robert M. Schwab. 1997. "Schoolhouses, Courthouses, and Statehouses after Serrano." *Journal of Policy Analysis and Management* 16(1), 10-31.

Figlio, David N., Husted, Thomas A., Kenny, Lawrence W. 2004. "Political economy of the inequality in school spending. Journal of Urban Economics." 55, 338 – 349

Garrison-Mogren, Roberta., Gutmann, Babette., and Bachman, Meredith. 2012. "State and District Receipt of Recovery Act Funds. A Report From Charting the Progress of Education Reform: An Evaluation of the Recovery Act's Role." Institute of Education Sciences. National Center for Education Evaluation and Regional Assistance. United States Department of Education.

Gordon, Tracy. 2012. "State and Local Budgets and the Great Recession." Brookings Institution. http://www.brookings.edu/research/articles/2012/12/state-local-budgets-gordon.

Hoxby, Caroline M., November 2001. All school finance equalizations are not created equal.

Quarterly Journal of Economics 16 (4)

Ihlanfeldt, Keith. R. 2011. How Do Cities and Counties Respond to Changes in Their Property Tax Base?. *The Review of Regional Studies*, *41*(1), 27-48.

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

Lutz, Byron., Molloy, Raven., and Shan, Hui. 2011. The housing crisis and state and local government tax revenue: Five channels. *Regional Science and Urban Economics*, *41*(4), 306-319.

Mead, Sara., Vaishnav, Anand., Porter, William., and Rotherham, Andrew. J. 2010. Conflicting Missions and Unclear Results.

Minorini, Paul., and Sugarman, Stephen. 1999. School finance litigation in the name of educational equity: its evolution, impact and future. *Equity and Adequacy in School Finance*, 34-71.

Murray, Sheila, Evans, William N., Schwab, Robert, September 1998. Education finance reform and the distribution of education resources. American Economic Review 88, 789 – 812.

Rentner, Diane Stark, and Ushe, Alexandra. 2012. What Impact Did Education Stimulus Funds Have on States and School Districts? Center on Education Policy.

United States Department of Education. 2011. Initial Guidance For States on the Education Jobs Program. Retrieved July 4, 2016 from http://www2.ed.gov/programs/educationjobsfund/legislation.html.

Figure 1
Time Series Plot of National Unemployment Rate and
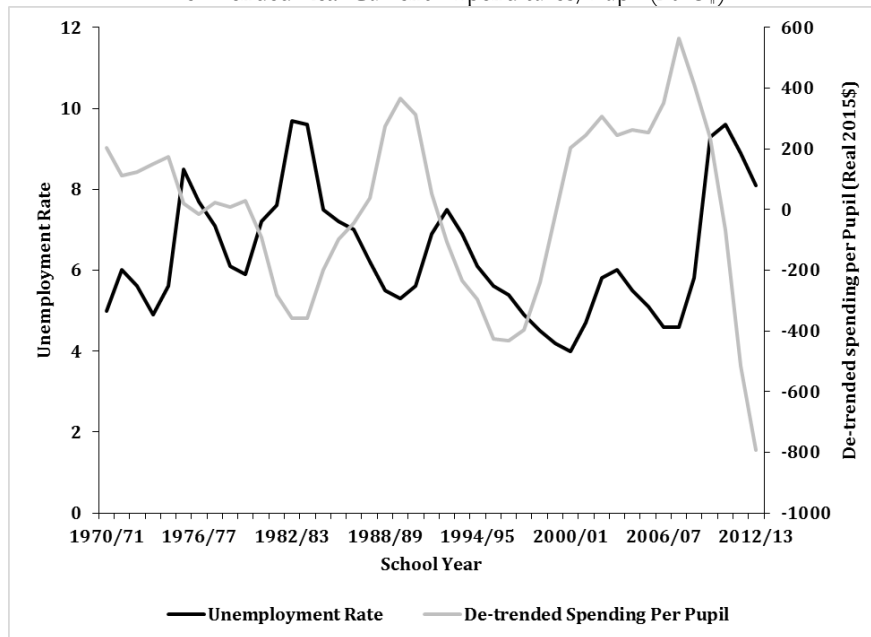De-Trended Real Current Expenditures/Pupil (2013$)

Figure 2
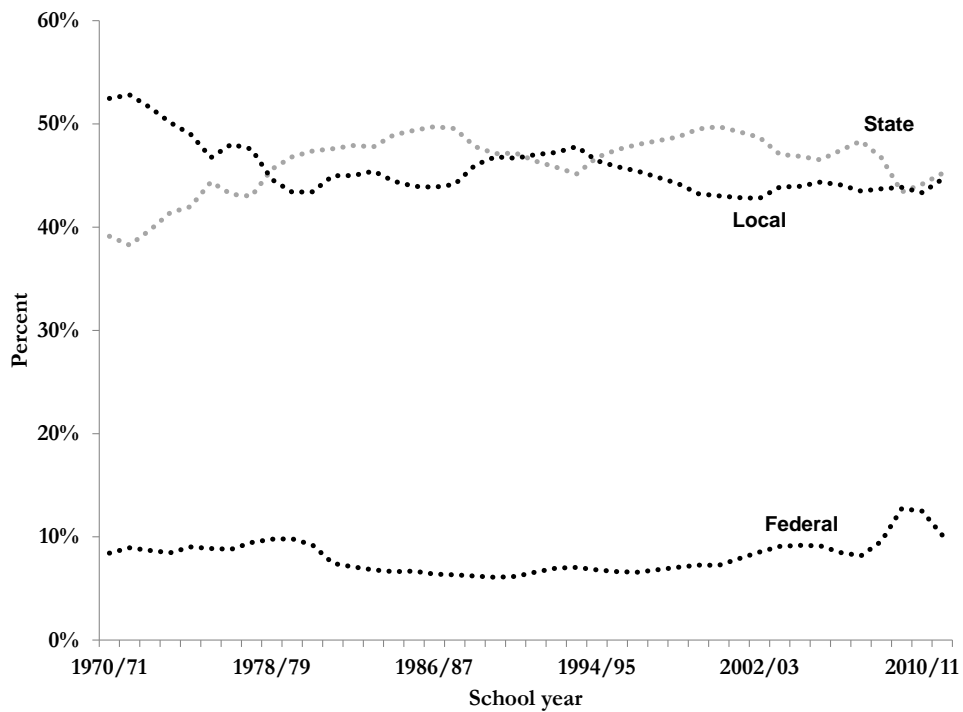Source of Revenues for K-12 Education, 1970/71 – 2011/12 School Years

Figure 3
Index of Four-Quarter Moving Average of Quarterly State and Local Tax Revenues from
Property, Sales, Income and Corporate Taxes over the Last Three Recessions (Start of Recession=100)

Figure 4
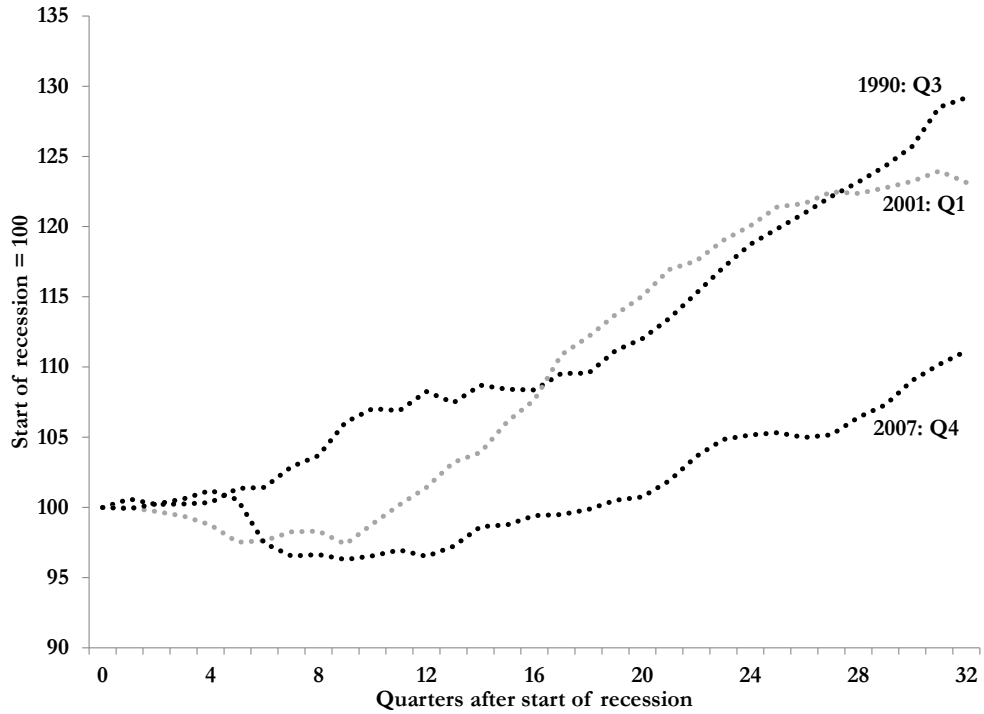Index of Four-Quarter Moving Average of Sources of State and Local
Tax Revenues over the Great recession (Start of the Recession =1000)

Figure 5
Employment Index for Four Sectors over the Great Recession,
BLS Current Employment Statistic (100 = Start of the Recession)
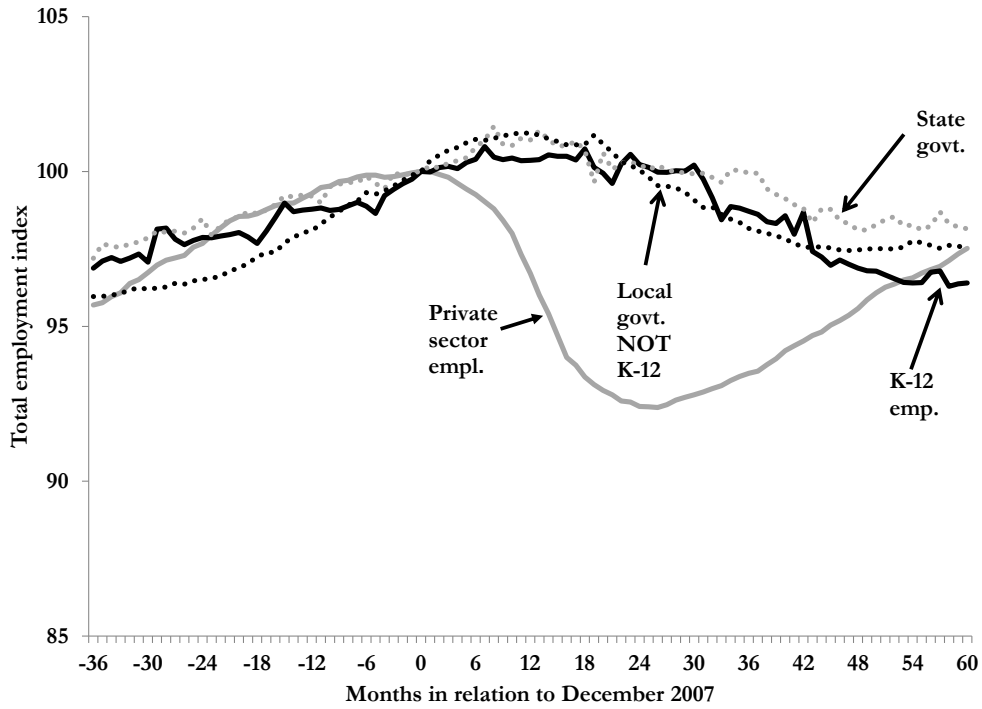
Figure 6
Teachers, Aids, Support Staff, and Other Education Employees,
1997/08 to 2013/14 School year (Index = 100 in 2007/08)
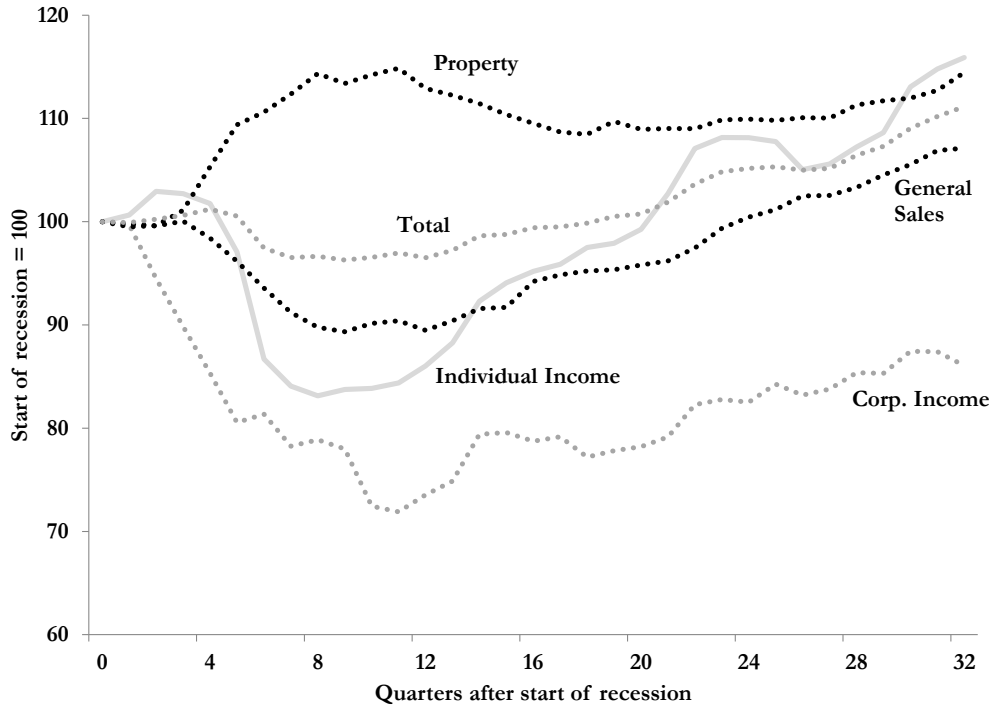

36

Figure 7
Employment Index for K-12 Education over the Last Four Recessions,
BLS Current Employment Statistics (100 = Start of the Recession)

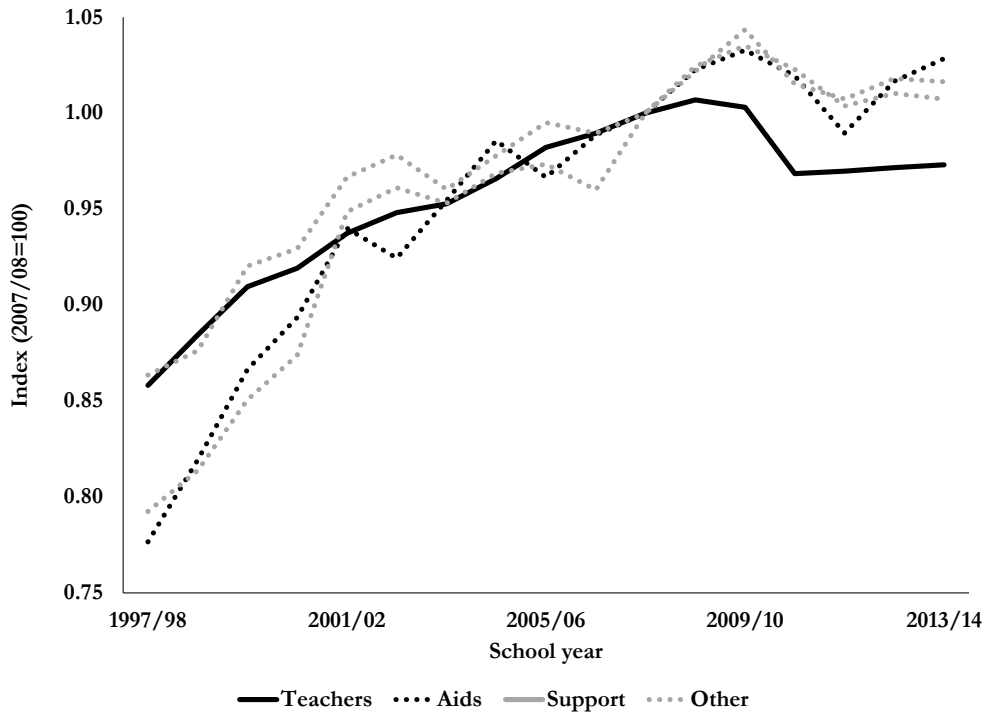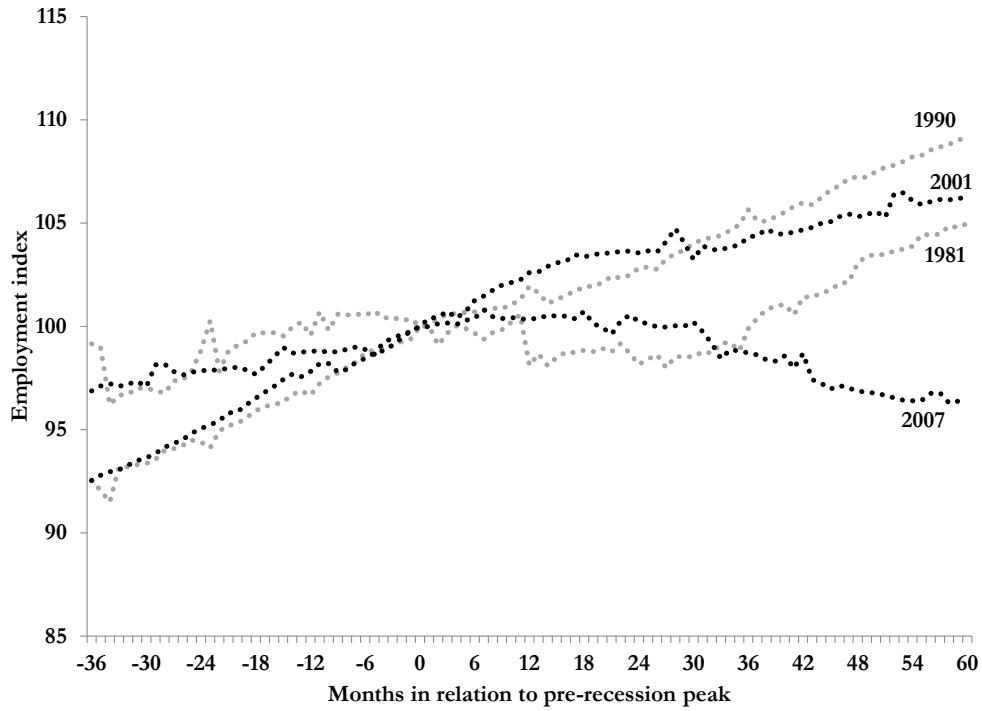Figure 8
Percentage Change in State Housing Price Index 2000 to 2011 vs.
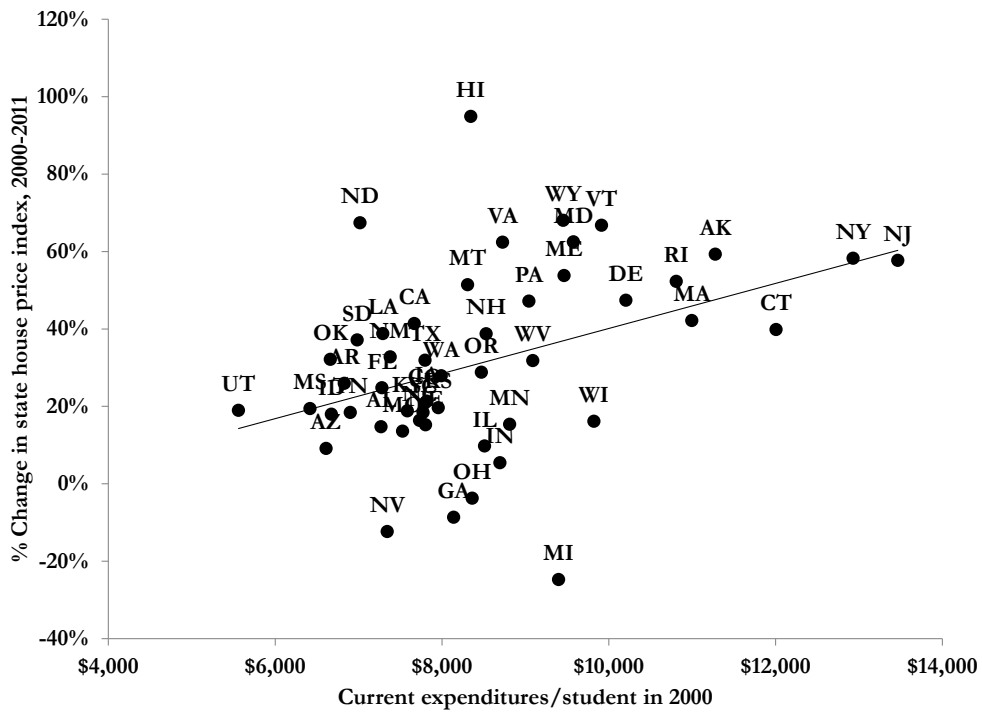Current Expenditures/Pupil in 2000

37

Figure 9
Scatter Plot of State Share of Revenues in FY08 Going to Districts vs.
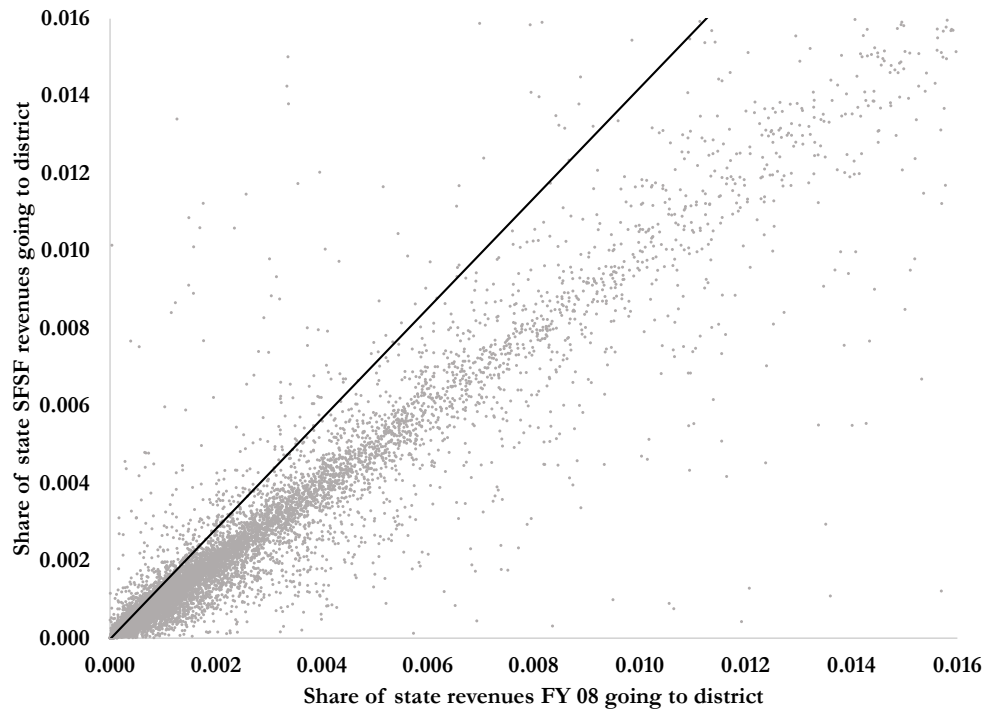State Share of SFSF Revenues Going to Districts

Table 1
State and Local Tax Revenues by Source, 2012
(in Millions of dollars)

Tax type	Tax source	State		Local		State+ Local	
		Total	Share	Total	Share	Total	Share
Income	Individual	$225,019	36.5%	$84,839	10.8%	$309,858	22.1%
	Corporate	$33,304	5.4%	$15,929	2.0%	$49,233	3.5%
Property		$10,233	1.7%	$464,167	59.3%	$474,400	33.9%
Sales	General	$185,043	30.0%	$111,224	14.2%	$296,267	21.2%
	Motor fuels	$31,357	5.1%	$11,173	1.4%	$42,530	3.0%
	Tobacco	$13,250	2.2%	$4,079	0.5%	$17,329	1.2%
	Alcohol	$4,516	0.7%	$1,953	0.2%	$6,469	0.5%
MV operator's license		$18,820	3.1%	$9,933	1.3%	$28,753	2.1%
Other taxes		$94,658	15.4%	$79,743	10.2%	$174,401	12.5%
Total		$616,200		$783,040		$1,399,240	

Source: Quarterly Summery of State and Local Taxes, US. Census Bureau.

Table 2
OLS Estimates, Percentage Change in District Property Tax Millage Rates, Peak to Trough
as a Function of the Change in Property Values Per Capita

		State and Fiscal Years Included				
		IL	WA	VA	TX	OH
		'08 to '11	'09 to '12	'06 to '11	'09 to '13	'08 to '12
(α_1)	D_i	-0.017	-0.073	0.031	-0.000	-0.019
		(0.013)	(0.0437)	(0.090)	(0.007)	(0.265)
(α_2)	$\%\Delta PVPC_i * D_i$	-0.034	-0.308	0.111	0.004	-0.181
		(0.042)	(0.210)	(0.436)	(0.041)	(0.159)
(α_3)	$\%\Delta PVPC_i * (1-D_i)$	-1.190	-1.536	-1.056	-0.097	-0.927
		(0.130)	(0.106)	(0.166)	(0.025)	(0.086)
Constant		0.048	0.143	-0.126	0.020	0.058
		(0.010)	(0.023)	(0.036)	(0.003)	(0.015)
P-value on test: $\alpha_2 = \alpha_3$		<0.0001	<0.0001	0.014	0.037	<0.0001
N		552	279	134	1021	612
R^2		0.335	0.601	0.267	0.018	0.265
Sample means (unweighted):						
% Δ tax rates		4.32%	23.6%	-0.24%	3.02%	9.60%
% $\Delta PVPC_i$		8.50%	-4.14%	-13.4%	-3.39%	-3.94%
$I(\% \Delta PVPC_i >0)$		67.2%	36.6%	12.7%	47.2%	34.9%

Regressions are weighted by size of the district in the earlier year.

Table 3

OLS Estimates of Equation Explaining % Change in Current Expenditures/pupil from 07/08 to 10/11

Covariates	All districts in sample (9,619 observations)			Districts in a CBSA (3,692 observations)		
	(1)	(2)	(3)	(4)	(5)	(6)
% Δ County per capita income, 07-11	0.195 (0.068) [0.014]	0.040 (0.030)	0.069 (0.040)	0.213 (0.099) [0.025]	0.027 (0.050)	0.122 (0.079)
Δ County unemployment rate, 07-11	-1.267 (0.313) [0.060]	0.546 (0.216)	0.249 (0.225)	-1.076 (0.301) [0.106]	0.759 (0.234)	0.379 (0.317)
% district revenues from state sources, 07	-0.090 (0.027) [0.005]	-0.026 (0.036)	-0.017 (0.036)	-0.085 (0.027) [0.009]	-0.024 (0.029)	-0.019 (0.029)
% Δ CBSA housing price index, 07-11				0.033 (0.045) [0.011]	-0.011 (0.037)	0.039 (0.065)
% Δ State per capita income, 07-11			0.048 (0.308)			-0.018 (0.328)
Δ State unemployment rate, 07-11			-2.637 (0.792)			-3.106 (0.818)
Share of state K-12 revenues from state sources '07			-0.197 (0.095)			-0.217 (0.079)
% Δ State housing price index, 07-11			-0.029 (0.074)			-0.114 (0.119)
Include state effects?	No	Yes	No	No	Yes	No
R²	0.1339	0.4701	0.2067	0.1607	0.4857	0.2432

There are 9,616 observations in the each regression. The numbers in parentheses are standard errors allowing for arbitrary correlation in errors across districts within a state. The numbers in square brackets are OLS standard errors.

Table 4

OLS Estimates of Equation Explaining % Change in Pupil-Teacher Ratio from 07/08 to 11/12

Covariates	All districts in sample (9,619 observations)			Districts in a CBSA (3,692 observations)		
	(1)	(2)	(3)	(4)	(5)	(6)
% Δ County per capita income, 07-11	-0.071 (0.075) [0.016]	-0.005 (0.029)	-0.031 (0.036)	-0.143 (0.158) [0.032]	0.046 (0.046)	-0.029 (0.097)
Δ County unemployment rate, 07-11	0.639 (0.717) [0.083]	-0.288 (0.165)	0.419 (0.219)	1.229 (0.613) [0.151]	-0.351 (0.390)	0.956 (0.583)
% district revenues from state sources, 07	0.107 (0.050) [0.007]	0.013 (0.017)	0.015 (0.023)	0.083 (0.054) [0.012]	-0.013 (0.022)	-0.017 (0.031)
% Δ CBSA housing price index, 07-11				0.069 (0.112) [0.013]	-0.012 (0.049)	-0.037 (0.087)
% Δ State per capita income, 07-11			-0.212 (0.438)			-0.411 (0.390)
Δ State unemployment rate, 07-11			1.491 (1.250)			1.050 (1.580)
Share of state K-12 revenues from state sources '07			0.275 (0.118)			0.286 (0.137)
% Δ State housing price index, 07-11			0.203 (0.151)			0.328 (0.122)
Include state effects?	No	Yes	No	No	Yes	No
R²	0.0413	0.4455	0.0925	0.0411	0.4758	0.0813

There are 9,755 observations in the each regression. The numbers in parentheses are standard errors allowing for arbitrary correlation in errors across districts within a state. The numbers in square brackets are OLS standard errors.

Table 5
Inequality in District-Level per Pupil Current Expenditures on K-12 Education, 1972-2013

| Year | Gini (x100) | 95-to-5 ratio | Coefficient of Var. (x100) | Theil Index (x 1000) | Between- and Within-state Theil Index | | | |
					Within States	Between States	% Within	% Between
1972	16.2	2.73	30.57	43.1	14.0	29.2	32.4	67.6
1982	13.7	2.21	25.53	30.7	13.8	16.9	45.0	55.0
1990	15.7	2.53	30.02	41.1	12.9	28.2	31.3	68.7
1992	15.1	2.47	29.44	39.0	11.9	27.1	30.4	69.6
1993	14.5	2.39	28.4	36.3	11.1	25.2	30.7	69.3
1994	14.0	2.33	27.8	34.5	9.9	24.6	28.8	71.2
1995	13.7	2.26	27.4	33.3	9.4	23.9	28.2	71.8
1996	13.3	2.20	26.5	31.4	8.9	22.5	28.4	71.6
1997	12.8	2.16	25.6	29.3	8.4	20.9	28.6	71.4
1998	12.2	2.11	24.5	26.8	8.2	18.7	30.5	69.5
1999	12.1	2.09	24.4	26.5	8.1	18.5	30.4	69.6
2000	12.0	2.08	24.2	26.2	8.0	18.2	30.6	69.4
2001	12.0	2.08	24.3	26.4	8.3	18.1	31.4	68.6
2002	12.3	2.10	24.9	27.7	8.6	19.1	31.1	68.9
2003	12.6	2.13	25.4	28.8	8.8	20.0	30.4	69.6
2004	13.1	2.16	26.7	31.4	9.4	22.1	29.8	70.2
2005	13.4	2.18	27.6	33.3	9.6	23.7	28.7	71.3
2006	13.5	2.20	28.2	34.5	10.0	24.4	29.1	70.9
2007	13.6	2.25	28.4	34.9	10.0	24.9	28.6	71.4
2008	13.8	2.27	28.8	36.0	10.5	25.5	29.1	70.9
2009	13.6	2.27	27.9	34.1	9.6	24.5	28.0	72.0
2010	13.9	2.32	28.6	35.8	9.6	26.2	26.8	73.2
2011	14.4	2.39	29.3	37.6	9.7	27.9	25.7	74.3
2012	15.1	2.47	31.2	42.0	9.9	32.1	23.6	76.4
2013	15.3	2.49	31.8	43.5	9.8	33.6	22.6	77.4

Data for 1972-1992 are from Corcoran and Evans (2009). All other calculations are by authors.

Table 6
Total Stimulus Funds Received by School Districts

CFDA #	Program Name	Total amount awarded (in millions of $)			# districts with awards		
		IES Estimate	Our sample	% diff.	IES Estimate	Our sample	% diff.
84.394	SFSF – Education	$28,895	$29,115	0.8%	13607	13341	-2.0%
84.389	Title 1, Part A	$8,835	$9,090	2.9%	12682	10876	-14.2%
84.391	Special Education Education	$8,844	$9,594	8.5%	9180	8716	-5.1%
84.386	Technology	$484	$517	6.8%	4710	4554	-3.3%
84.387	Education Homeless	$55	$52	-6.0%	1342	1230	-8.3%
84.392	Special Ed. -- Preschool	$285	$320	12.8%	5427	5237	-3.5%
	Total	$47,399	$48,690	2.7%	14493	15382	6.1%

Table 7
2SLS Results of Impact of Stimulus Spending on School District Outcomes,
Balanced Panel of Districts, FY0506 – FY1011

Dependent Variable: Covariates	OLS	2SLS			
	$SFSF_{ij}^{t} / Pupil_{ij}^{t}$	$S_{ij}^{t} / Pupil_{ij}^{t}$	Local rev./Pupil	Total rev./Pupil	Employment/ Pupil
$INST_{ij}^{t} / Pupil_{ij}^{t}$	0.881 (0.102)				
$SFSF_{ij}^{t} / Pupil_{ij}^{t}$		-0.936 (0.256)	0.103 (0.206)	0.239 (0.258)	-0.000 (0.000)
1st stage F (P-value)	66.8 (<0.0001)				
P-value, $\beta = -1$		0.802	0.000	0.000	0.000
R^2	0.887	0.429	0.2668	0.3668	0.1851

Standard errors in parentheses allow for arbitrary correlation in errors within a state. There are 6 observations per district for 9,450 districts for 56,700 observations. Other covariates in the model are state-specific year effects and district fixed-effects. We cluster the standard errors at the state level. Results are weighted by annual student enrollment.