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The Great Recession and Public Education

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Abstract

We examine the impact of the Great Recession on public education finance and employment.

Five major themes emerge from our work. 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. We argue,

however, that we need to be very cautious about 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. Fifth, the federal government's efforts to shield education

from some of the worst effects of the recession achieved their major goal.

<A>I. Introduction

The recession that began in December 2007 was the most severe economic downturn in the U.S. 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,] Analysts often call this period the Great Recession (GR), a term that is well-deserved.

In this paper we look at the impact of the recession on public schools. Our goal is to describe what happened to K-12 public education during the recession and to learn what we can about how to shield schools and their students from the worst effects of any future recessions.

Other papers have examined the impact of the GR on education. Several have focused on New York and New Jersey schools. Bhalla, Chakrabarti, and Livingston (2017) show that New York schools fared much better than New Jersey schools. New York received more than twice as much federal aid per pupil than New Jersey and New Jersey state aid to schools fell much more sharply. Chakrabarti, Livingston, and Setren (2015) found that, in New York, increases in federal aid largely offset decreases in state aid, and consequently the recession had little impact on the overall level of education spending in the state. They also showed that the recession hit wealthy school districts the hardest. Chakrabarti and Sutherland (2013) argue that in New Jersey, non-instructional expenditures declined much more than instructional expenditures, non-tenured teachers were more likely to be laid off, and expenditures in high poverty and urban school districts fell significantly.

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[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. The U.S. Bureau of Labor Statistics classifies someone as long-term unemployed if they have been unemployed for at least 27 weeks.

In this paper, rather than examining the experience of a few states, we take a somewhat broader perspective. In Section II we present a brief overview of the structure of education finance in the U.S. and then look at the aggregate 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 use a balanced panel of district-level data to determine 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. In Section IV, we continue our work with the panel of districts and 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 GR on public education. Section VI includes a brief summary and conclusions.

Five major themes emerge from our work. First, the impact of the GR was unprecedented. Nearly 300,000 school employees lost their jobs, wiping out the aggregate gains made in reducing class size during the 13 years before the recession. It took five years for state and local revenues to return to the pre-recession levels.

Second, schools in states where districts were heavily dependent on funds from state governments were particularly vulnerable to the effects of the GR. There has been a marked shift towards state-financed public schools over the past 40 years, in part as a result of litigation and legislation to equalize school resources across districts. We show that revenues from the major state taxes -- income and sales taxes -- fell sharply over the GR. Our results suggest that an

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unintended side effect of these efforts has been to make school spending 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 course of the recession. 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 GR. School spending inequality had risen steadily since 2000 and the trend in inequality in the 2008 to 2013 period is similar to the trend we see in the 2000 to 2008 period. Thus while the gap in spending between wealthy and poor schools rose during the recession, the role of the recession is much less clear.

Fifth, we argue that the federal government's efforts to shield education from some of the worst effects of the GR 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.

<A>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.

<B>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.[4] Education spending, however, is sensitive to the business cycle. In

Figure 1 we graph the de-trended residuals of real per student current expenditures versus the

national unemployment rate.[5] The graph shows a strong negative relationship between these two

series except for the mid-1990s. [6,7] 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 U.S.

over the last 40 years. In Figure 2 we summarize 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

part of the 20th century, nearly 80 percent of the revenues for public education came from local

governments. [9] 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

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[4] 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 expenditures 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 non-instructional functions. It excludes expenditure for debt service, capital outlay, and reimbursement to other governments (including other school systems).

[5] http://research.stlouisfed.org/fred2/series/UNRATE/.

[6] We estimated the correlation between the data series to be -0.23. Though this is not incredibly large in magnitude it does suggest a clear negative relationship between student spending and unemployment.

[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.

[9] http://nces.ed.gov/pubs93/93442.pdf

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 GR in response to falling state and

local tax revenues. As a consequence, in 2010 the federal share of education spending reached 13

percent. In the last several years the federal role has moved back toward historical levels.

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 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.

There is significant variation in state tax structures. Seven states have no income tax (and

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[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); LaFortune, Rothstein, and Schanzenbach (2016); and Candelaria and Shores (forthcoming).
[11] https://www.census.gov/govs/qtax/.

two others tax only dividend and interest income); five states do not have a sales tax.[12] Despite

this heterogeneity, the income and sales taxes are 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

then expect that the collapse of the housing markets at the start of the GR might have had a

particularly severe impact on schools. We consider this issue in the next section of the paper.

<B>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 GR on the financing of public K-12

education.[13] The impact of the GR on state and local tax revenues was dramatic. In Figure 3, we

present a four-quarter moving average index of real state and local tax revenue from the four

largest sources of revenues (property taxes, income taxes, sales taxes and corporate income

taxes).[14] We present data for the GR (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).[15] 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 GR on state and local tax revenue was

unprecedented. State and local revenues were constant for about a year after the start of the

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[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.
[14] http://www.census.gov/govs/qtax/ The four-quarter moving average is constructed by averaging the real value of the current quarter with the three quarters prior to it.
[15] We use the GDP implicit price deflator to generate real values and a four-quarter moving average because of very large within fiscal year variation in quarterly revenues.

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 rolls grew by 11.8 million people – an increase of 28 percent – between 2007 and 2012.[16]

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 GR 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 GR. All of the indexes are set to 100 at the start of the recession. 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 two percent below its 2007 levels 20 quarter later. Sales tax revenues declined more slowly than income tax revenues but these revenues were eight percent below the 2007 level 15 months later. Revenues from corporate income taxes reached a nadir 11 quarters after the start the GR and were down 28 percent. Corporate income and sales taxes were still lower by 22 and four percent, respectively, five years after the start of the GR.

Property taxes followed a very different pattern. As Figure 4 shows, revenues from property taxes actually grew steadily during the first three years of the recession. They then fell

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[16] http://kff.org/other/state-indicator/monthly-medicaid-enrollment-in-thousands-june/

slightly but remained 10 percent above pre-recession levels 15 quarters. This is in some ways a surprising result. The housing market collapse was a key element of the GR. 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.[17] 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. [18] 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 unmatched.

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.[19] It is difficult to square two seemingly inconsistent results: the property tax fared much better than other state and local taxes during the GR even though the property tax base collapsed.

Several papers have noted that local jurisdictions seem to have the ability to raise property tax rates to offset property value declines. Lutz, Molloy, and Shan (2011) find that assessed values lag market values in many states, which help to support property tax revenues

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[17] http://us.spindices.com/indices/real-estate/sp-case-shiller-us-national-home-price-index
[18] https://www.census.gov/construction/nrc/historical_data/
[19] Statistics are from Lutz, Molloy, and Shan (2011).

when house prices fall. They do find that, in aggregate, property tax millage rates rise when

property values decline. These results are born out in analyses of specific states including

Georgia (Alm, Buschman, and Sjoquist 2011), New York (Chakrabarti, Livingston, and Roy

2014), and Florida (Ihlanfeldt 2011).

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

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

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

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[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 at http://www.k12.wa.us/safs/PUB/FIN/1213/fs.asp. Data for Texas is available at http://www.tea.state.tx.us/index2.aspx?id=2147504614&menu_id=645&menu_id2=789. Illinois data is available at http://webprod1.isbe.net/ilearn/ASP/index.asp. The data for Ohio for tax year 2012 is available at 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.

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). Because all the variables of interest are in percent changes, the coefficients on α_2 and α_3 are elasticities. The elasticity of the tax rate with respect to tax base changes 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 presents our OLS estimates of (1) for five states. In the final column, we report estimates from a model that pools these five states and adds a state dummy to the model. We can reject the hypothesis that government response is symmetric in all models at the five percent level. In all six models, we cannot reject the null that $\alpha_2 = 0$ suggesting that tax rates do not adjust down when property values increase. In contrast, 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. We can reject the null that $\alpha_3=0$ in all cases. We cannot reject the hypothesis that changes in the property tax rate fully offset changes in the tax base for Illinois, Virginia, Ohio, and the pooled sample. For Washington (Texas), our estimate of α_3 is statistically smaller (larger) 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 important policy implications. All taxes are unpopular, but the property tax is often seen as one of the most unpopular of all.[21] It is highly visible because taxpayers typically pay it directly. 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 stable source of revenue. Property tax revenues in the past have been relatively insensitive to the business cycles. But until the GR, 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 GR tells us that the stability of the property tax is a more 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.

As we noted above, states have assumed a larger role in education finance over the last 40 years and rely on more volatile forms or funding. This shift toward state funding may have an unintended side effect. It could have made public education funding much more sensitive to the effects of the GR. We will present some further evidence on this point in section III of the paper.

<B>*C. Employment in Public K-12 Education*

We now turn to the effect of the GR on employment in K-12 education. Our primary data source here is the monthly U.S. Bureau of Labor Statistics (BLS) Current Employment Statistics, 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 allow us to consider the impact of the

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

recession on jobs for teachers separately from other educational employment that may not be as actively involved in the classroom environment such as administrators, guidance counselors, and librarians.

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 GR. Each series is scaled so that it equals 100 at the start of the recession. 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. Second, the recession took a substantial toll on public education. Jobs for school employees 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 GR. In total, 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 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 1989/90 and 2003/04 school year, which was a 4.5 percent decline. The GR thus wiped out 13 years of decline in the pupil/teacher ratio in just three years.[23]

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[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

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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 1997/98 through 2013/14

school years 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 1997/98 and 2008/08: teachers and support staff increased 14 percent, other

employees 21 percent, and aids 22 percent over that year period. Employment peaked in 2008/09

and over the next three school years, the number of teachers fell 3.7 percent compared to a

decrease of just 1.4 percent for support staff. Teachers represented 51 percent of employment in

2008 but were responsible for 63 percent of job loss over the first three years of the GR

Figure 7 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 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 GR on teachers and other personnel was unparalleled. In

the 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

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

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. Which Schools Were Impacted the Most by the Great Recession?

We now shift gears and look at the effect of the GR on district spending for K-12

education. In this section, we examine how the structure of school finance in a state or school

district affect the impact of the recession on schools.

To address this question, we have developed a balanced panel school district data. We

describe the construction of our data set in the online appendix to this paper. Specifically, 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.[25] Because of missing data, the final data set excludes many

districts, mostly ones with smaller enrollments.[26] As a consequence, while the data set contains

only 71 percent of all regular districts, those districts account for 88 percent of all public school

students.

We initially focus on one question: which schools were affected most severely by the

GR? 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

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[25] According to the 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.
[26] Average enrollment in dropped districts was 3,277 students versus 4,232 students in sample districts

primarily on property taxes, and property tax revenues were fairly stable during the GR.

We use our balanced panel of school districts described above to shed light on this issue. The dependent variable in this econometric work is the percent change in per student spending 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 at the school district level. We therefore use the percentage change in county-level per capita income from 2007 to 2011 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 residuals in parentheses.

Looking at the parameter estimates and the OLS standard errors, we find what we think 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.[29] 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.

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[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

[29] In our sample, 45.8 percent of the variation in the share of education revenue from the state in 2007 is within state and across districts; the remaining 54.2 percent of the variation is across 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 capture 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. We drop the state effects and add in four variables measured at the state level:

the percentage change in real per capita income from 2007-11,[30] the change in the state

unemployment rate,[31] 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.[32] 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 revenues 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 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

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[30] 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.
[31] 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.
[32] This data is available for download at http://www.freddiemac.com/finance/fmhpi/.

calculated at the level of the Core Based Statistical Area (CBSA).[33] In the final three columns of

Table 3 we reduced the sample to the 3,692 districts that are located in CBSAs, and so we can

add a local housing price index as a covariate when we use this restricted sample. 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 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

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

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 and statistically significant.

IV.   The Impact of the Recession on School Spending Inequality

In the previous sections we focused largely on how the GR altered average spending

outcomes. Here we turn to the impact of the recession on inequality in education spending.

Inequality in income and wealth rose throughout much of the last half-century. Inequality in

education spending, however, fell during much of that period (Corcoran and Evans 2015;

Murray, Evans, and Schwab 1998). Here we ask if this trend continued during the GR.

We consider inequality in current expenditures per pupil from unified districts over a

long period. For data prior to 1993, we use measures of inequality reported by Evans and

Schwab and their various coauthors, while for 1993 and on, we rely on the panel data from the

previous section. In all, we have data for ten-year intervals from 1972 until 1992, 1990, and

annual data from 1993.

We look at four measures of inequality.[34] 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

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 to

the mean of school spending. The final measure is the Theil index, which has the convenient

property that it can be decomposed into between and within state measures of inequality.

The time series for the four national estimates of between-district inequality are presented

in Table 5. In the first row, we report the baseline levels of the inequality measures. After that,

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

for ease of exposition, we report indexes of the measures with the baseline year (1972) equal to 1.00. 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 21 and 39 percent during that period. The U.S. 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 undid virtually all of the progress that was made during the preceding 29 years. By 2013, the coefficient of variation and the Thiel index were essentially at their 1972 values. Although finance reform was able to reduce inequality, the success was fleeting.

The last four columns of Table 5 exploit the unique properties of the Thiel index of inequality and look at the national, between-state and within-state measures of current expenditures per pupil. For the within- and between-state measures, we divide by the total Thiel index in 1972 so these two measures sum to the indexed value. Both measures fell sharply from 1972 to 2000. Within-state inequality fell by 41 percent and between-state inequality fell by 38 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. Murray, Evans, and Schwab (1998), for example, found that court-ordered education finance reform did significantly decrease within-state inequality in spending.

Although rising between- and within-state inequality both contributed to the overall increase in inequality in education spending starting in 2000, the main factor here is growing differences between the states in school spending. Between-state inequality rose by 86 percent between 2000 and 2013; within-state inequality in spending rose by just 21 percent during the period.

It is not clear that the GR 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 GR 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 U.S. 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, 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 -- a result we found for five states in Table 2 -- this would help to explain the

growth in the between-state inequality in expenditures.

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

<B>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.[35] 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.[36] 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), a new, one-time appropriation of

$53.6 billion. Of this amount, the U.S. Department of Education (DOE) 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.[37]

The purpose of these funds was to help stabilize state and local government budgets in order to

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[35] Pl 111-5. https://www.gpo.gov/fdsys/pkg/PLAW-111publ5/pdf/PLAW-111publ5.pdf
[36] This section draws heavily on http://www2.ed.gov/policy/gen/leg/recovery/factsheet/stabilization-fund.html
[37] 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.

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.

The ARRA specified that 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 were 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 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 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, K-12 education, and support of 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, signed into law on August 10, 2010, was the second

major federal effort to offset some of the effects of the GR on public education.[38] It provided

$10 billion in assistance to save or create education jobs for the 2010-2011 school year. The

DOE determined the allocation for each state[39] by formula on the basis of (1) its relative

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[38] 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).
[39] 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.

population of individuals who are aged 5 to 24, and (2) its relative total population.[40] States

were required to distribute these funds to school districts *either* through the State's primary

elementary and secondary education funding formula(e) *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 were available.

There have been several efforts to evaluate the impact of SFSF and the Education Job

Funds. In their studies of the New Jersey and New York experiences, Chakrabarti and Livingston

(2013a, 2013b) found that stimulus funds were an effective stopgap when state funding fell

sharply at the start of the recession. They also found that when the stimulus funding ended in

2011, education spending in both states fell since state and local funding sources had not fully

recovered. 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.[41] 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 submissions of the first ARRA

quarterly reports, the study argued that over 250,000 education jobs have been retained or

created through ARRA.[42]

<B>*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 database to data from the Common Core

and F33 outlined above. 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

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[40] For purposes of this program, the District of Columbia and Puerto Rico are defined as States.

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

[42] Rentner and Ushe (2012) tracked the use of ARRA and Education Jobs funds and the implementation of ARRA-related reforms. These six reports were based on survey responses of state and local officials charged with implementing these programs.

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

DOE (Garrison-Mogren, Gutmann, and Bachman 2012). 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 from the IES report 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

record more grant dollars.

<B>*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

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

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.[43]

We face 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 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.

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[43] 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.

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 were in

rural areas (58 versus 55 percent).[44] Overall, districts NOT receiving SFSF funds represent only

1.1 percent of all students and 2.1 percent of all districts in our sample.

In general, states distributed SFSF money in a way similar to the way they distributed

other state funds. 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. This is not surprising given the structure of SFSF as

described earlier in this section of the paper. The fact that states distributed SFSF funds in a

similar way to other state revenues will be exploited in a 2SLS procedure below. In particular,

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 $SFSF_{ij}^t / Pupil_{ij}^t$ is then

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[44] These numbers are based on data from the FY08 F-33 data.

$$INST_{ij}^t/Pupil_{ij}^t = \frac{\theta_{ij}^{08} SFSF_j^t}{Pupils_{ij}^t} \tag{3}$$

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 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 Panel A in Table 6, 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 0.83 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 (4) in the second column of Panel A Table 6. The estimated

coefficient on $SFSF_{ij}^t / Pupil_{ij}^t$ is -0.94 with a standard error of 0.256. We therefore can easily

reject the null that the coefficient is zero. We cannot, however, reject the hypothesis that federal

SFSF money fully offset the decrease in state funds for education, i.e., that the coefficient of

interest is equal to -1; the p-value on this second null hypothesis is -1 is 0.80. The results in

Panel A Table 6 therefore suggest that the SFSF program worked 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.

We examine the impact of SFSF spending on several key variables in the final three columns of Panel A Table 6. Here we replace state funding per pupil as the outcome with local revenues per student (column 3), total revenues per student (column 4) or education employment per student (column 5). In 2SLS models, we find that SFSF funds are uncorrelated with these three variables. Total spending would include SFSF spending and so this result implies that federal funds were able to fully offset decreases in state and local funding.

We present estimates of a falsification analysis of our model in Panel B of Table 6. In this analysis we consider several school district characteristics that should not be affected by SFSF spending. These characteristics are the fraction of students that are black, Hispanic, with an individual education plan (IEP), and on free or reduced lunch. Estimates of the impact SFSF on these characteristics in Panel B Table 6 are statistically insignificant and virtually zero. This offers support for the validity of our 2SLS analysis.

VI. Summary and Conclusions

This project sought to answer one overriding question: how did the Great Recession affect public schools? Our work has produced some interesting answers 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 GR. 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 GR led to a steep decrease in state tax

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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 the surprising result that the GR had a much smaller impact on local support for education. 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. This turned out not to be the case. As we showed in some of our state case studies, school districts were 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. The ease with which local governments can change the property tax stands in stark contrast to voter sentiment about the property tax. Our results suggest that one possible reason voters dislike the property tax is that local government spending always rises. When property values per capita are increasing, the millage rate is left unchanged indicating that total revenues/pupil increases in those situations. In contrast, when property value declines, the millage rate is increased enough to make up for any revenue shortfall. Local revenues/pupil are almost immune from reductions.

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

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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 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.

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http://www2.ed.gov/programs/educationjobsfund/legislation.html.

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, U.S. 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	Pooled
	'08 to '11	'09 to '12	'06 to '11	'09 to '13	'08 to '12	Sample
(α_1) D_i	-0.017	-0.073	0.031	-0.000	-0.019	0.013
	(0.013)	(0.0437)	(0.090)	(0.007)	(0.265)	(0.014)
(α_2) %ΔPVPC$_i$ * D_i	-0.034	-0.308	0.111	0.004	-0.181	-0.020
	(0.042)	(0.210)	(0.436)	(0.041)	(0.159)	(0.072)
(α_3) %ΔPVPC$_i$ * (1-D_i)	-1.190	-1.536	-1.056	-0.097	-0.927	-0.959
	(0.130)	(0.106)	(0.166)	(0.025)	(0.086)	(0.036)
Constant	0.048	0.143	-0.126	0.020	0.058	0.051
	(0.010)	(0.023)	(0.036)	(0.003)	(0.015)	(0.013)
P-value on test: $\alpha_2 = \alpha_3$	<0.0001	<0.0001	0.014	0.037	<0.0001	<0.0001
N	552	279	134	1021	612	2,598
R^2	0.335	0.601	0.267	0.018	0.265	0.410
Sample means (unweighted):						
% Δ tax rates	4.32%	23.6%	-0.24%	3.02%	9.60%	6.8%
% ΔPVPC$_i$	8.50%	-4.14%	-13.4%	-3.39%	-3.94%	-1.6%
I(% ΔPVPC$_i$ >0)	67.2%	36.6%	12.7%	47.2%	34.9%	45.7%

Regressions are weighted by size of the district in the earlier year. The regression in the final column also has state effects.

Table 3

OLS Estimates of Equation Explaining % Change in Current Expenditures/pupil from 2007/08 to 2010/11

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
R^2	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 2007/08 to 2011/12

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
R^2	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
				Actual values at baseline				
1972	16.2	2.73	30.57	43.1	14.0	29.2		
			Index values with 1972=1.00					
1972	1.00	1.00	1.00	1.00	0.32	0.68	32.4	67.6
1982	0.85	0.81	0.84	0.71	0.32	0.39	45.0	55.0
1990	0.97	0.93	0.98	0.95	0.30	0.65	31.3	68.7
1992	0.93	0.90	0.96	0.90	0.28	0.63	30.4	69.6
1993	0.90	0.88	0.93	0.84	0.26	0.58	30.7	69.3
1994	0.86	0.85	0.91	0.80	0.23	0.57	28.8	71.2
1995	0.85	0.83	0.90	0.77	0.22	0.55	28.2	71.8
1996	0.82	0.81	0.87	0.73	0.21	0.52	28.4	71.6
1997	0.79	0.79	0.84	0.68	0.19	0.48	28.6	71.4
1998	0.75	0.77	0.80	0.62	0.19	0.43	30.5	69.5
1999	0.75	0.77	0.80	0.61	0.19	0.43	30.4	69.6
2000	0.74	0.76	0.79	0.61	0.19	0.42	30.6	69.4
2001	0.74	0.76	0.79	0.61	0.19	0.42	31.4	68.6
2002	0.76	0.77	0.81	0.64	0.20	0.44	31.1	68.9
2003	0.78	0.78	0.83	0.67	0.20	0.46	30.4	69.6
2004	0.81	0.79	0.87	0.73	0.22	0.51	29.8	70.2
2005	0.83	0.80	0.90	0.77	0.22	0.55	28.7	71.3
2006	0.83	0.81	0.92	0.80	0.23	0.57	29.1	70.9
2007	0.84	0.82	0.93	0.81	0.23	0.58	28.6	71.4
2008	0.85	0.83	0.94	0.84	0.24	0.59	29.1	70.9
2009	0.84	0.83	0.91	0.79	0.22	0.57	28.0	72.0
2010	0.86	0.85	0.94	0.83	0.22	0.61	26.8	73.2
2011	0.89	0.88	0.96	0.87	0.23	0.65	25.7	74.3
2012	0.93	0.90	1.02	0.97	0.23	0.74	23.6	76.4
2013	0.94	0.91	1.04	1.01	0.23	0.78	22.6	77.4

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

Table 6
2SLS Results of Impact of Stimulus Spending on School District Outcomes,
Balanced Panel of Districts, 2005/06 – 2010/11

	Panel A: Impacts to Per Pupil Revenues and Employment				
	OLS	2SLS			
Dependent Variable: Covariates	$SFSF_{ij}^t / Pupil_{ij}^t$	$S_{ij}^t / Pupil_{ij}^t$	Local rev./Pupil	Total rev./Pupil	Employment/ Pupil
$INST_{ij}^t / Pupil_{ij}^t$	0.831 (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)				
R^2	0.887	0.429	0.2668	0.3668	0.1851

	Panel B: Falsification Tests – Impacts on Student Demographics				
	OLS	2SLS			
Dependent Variable: Covariates	$SFSF_{ij}^t / Pupil_{ij}^t$	Fraction Black	Fraction Hispanic	Fraction IEP	Fraction Free/Red Lunch
$INST_{ij}^t / Pupil_{ij}^t$	0.824 (0.105)				
$SFSF_{ij}^t / Pupil_{ij}^t$		-0.00002 (0.00000)	-0.00000 (0.00000)	0.00000 (0.00000)	-0.000018 (0.00002)
1st stage F (P-value)	61.91 (<0.0001)				
R^2		0.2448	0.4155	0.4064	0.4407

Standard errors in parentheses allow for arbitrary correlation in errors within a state. **Panel A**: 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. **Panel B:** As a falsification test, estimates in Panel B explore the impact of SFSF funds on district demographics. Due to a small number of districts not reporting demographic information every year, the balanced sample is slightly smaller than in Panel A. The first stage estimates are not greatly altered as a result of this. 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.

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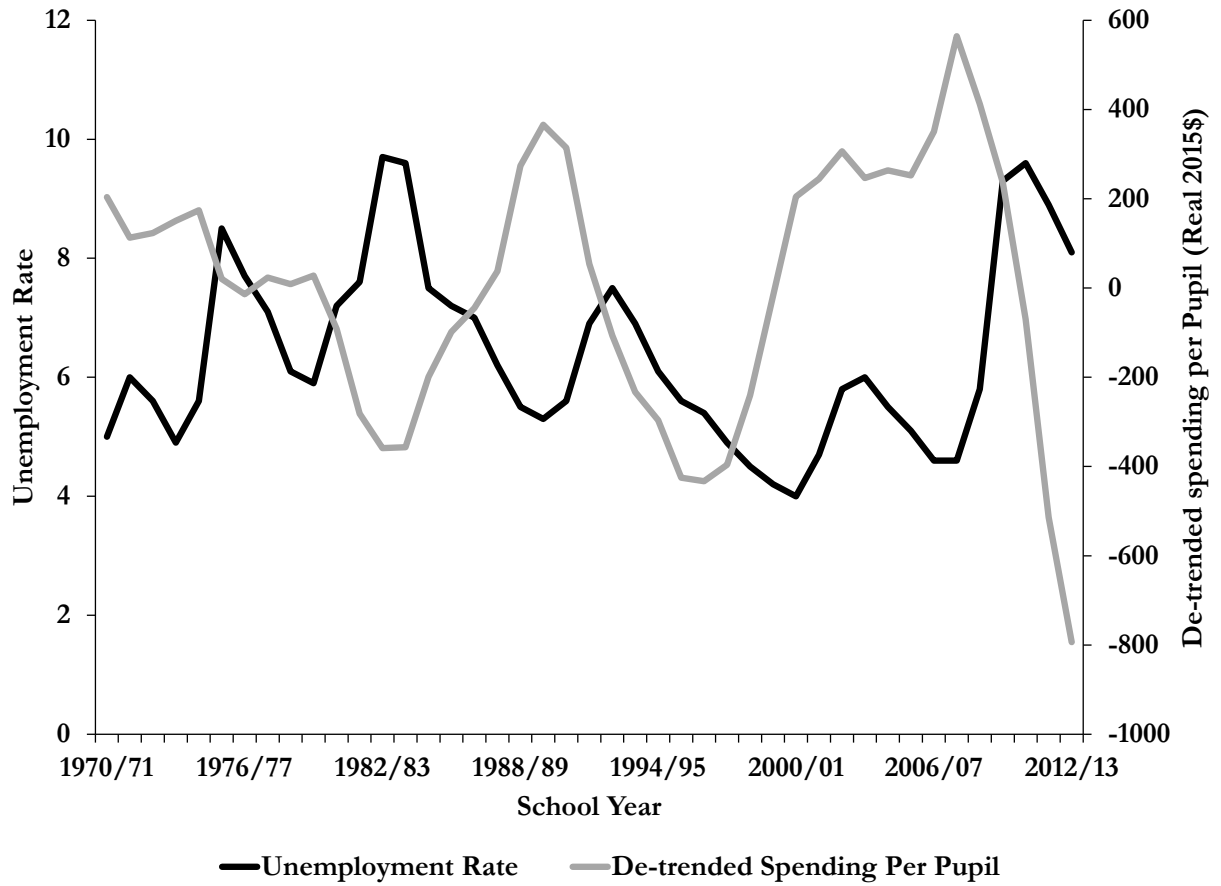De-Trended Real Current Expenditures/Pupil (2013$)

Figure 2
Source of Revenues for K-12 Education, 1970/71 – 2011/12 School Years
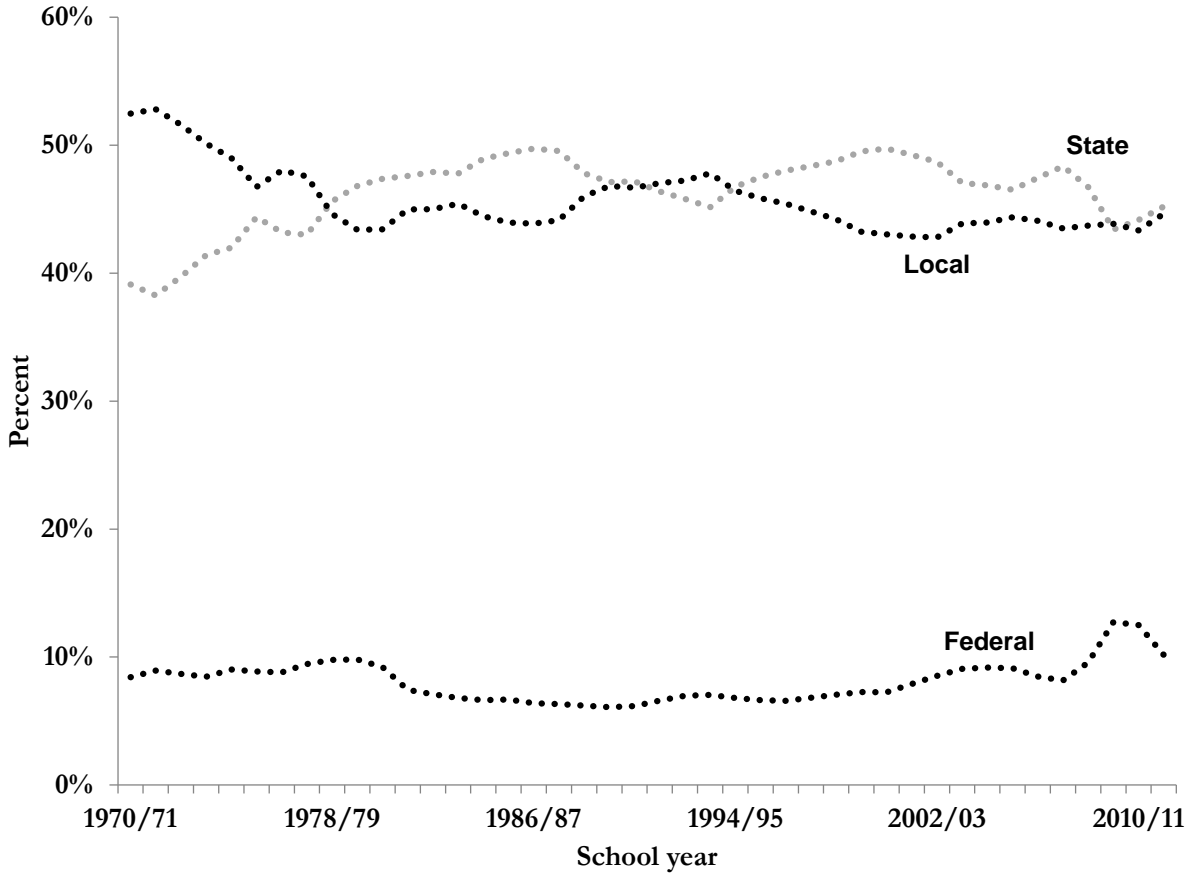
Figure 3
Index of Four-Quarter Moving Average of Quarterly State and Local Tax Revenues from
Property, Sales, Income and Corporate Taxes over the Last Three Recessions
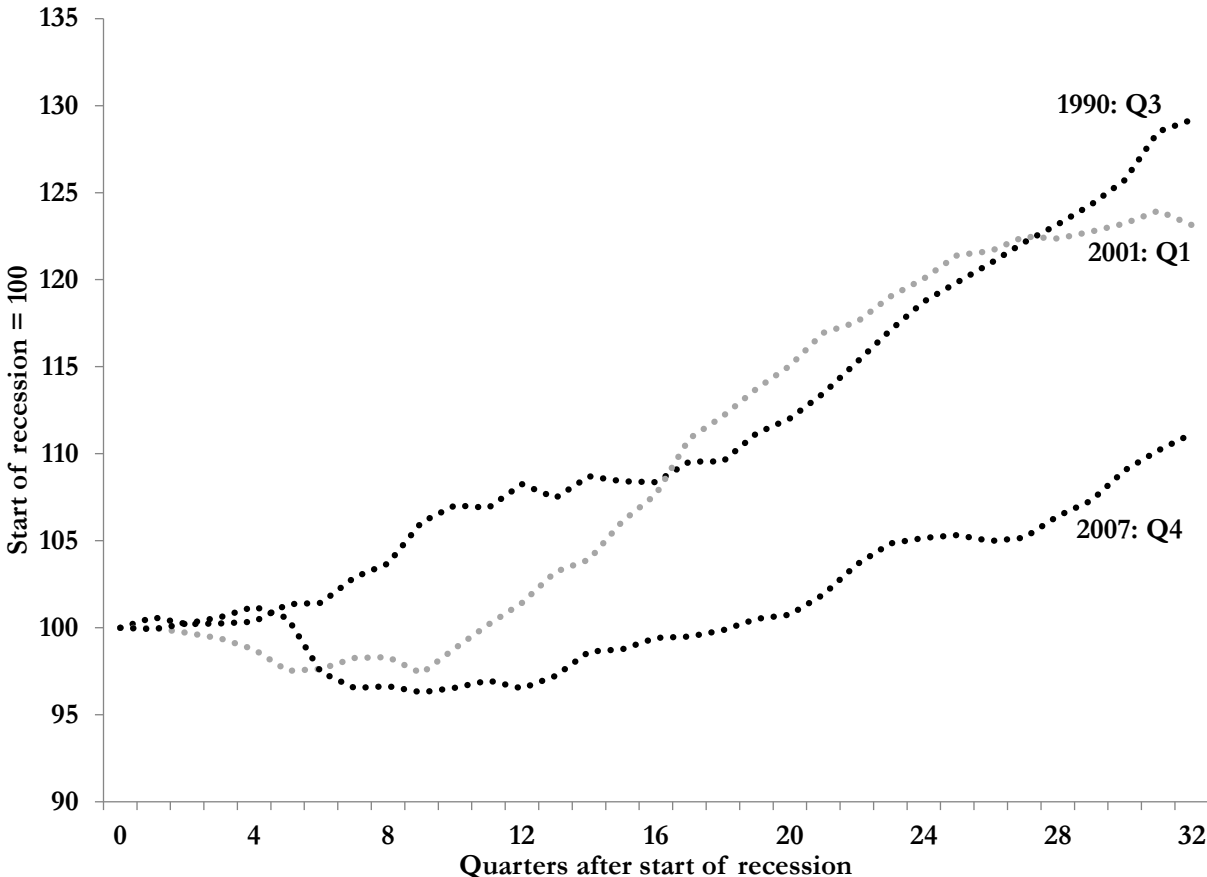(Start of Recession=100)

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)
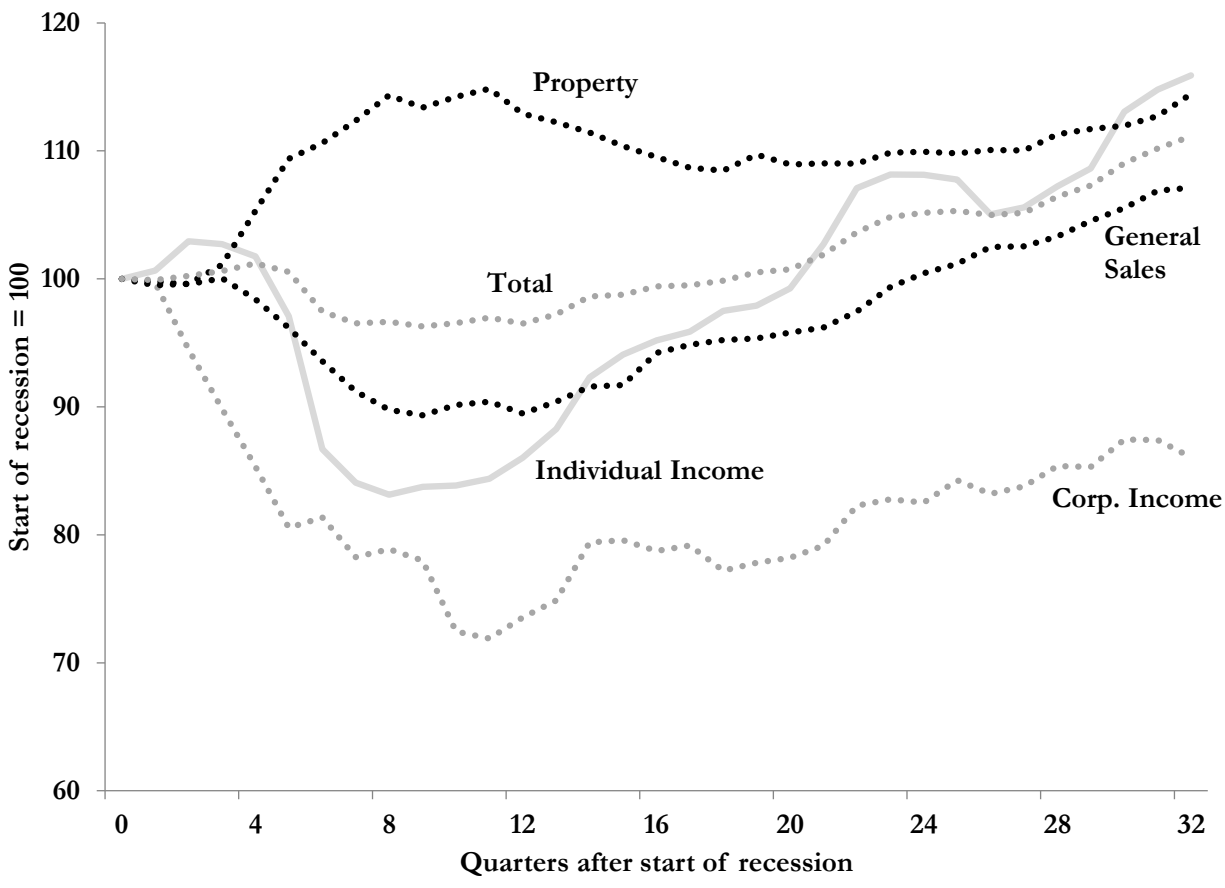
Figure 5
Employment Index for Four Sectors over the Great Recession,
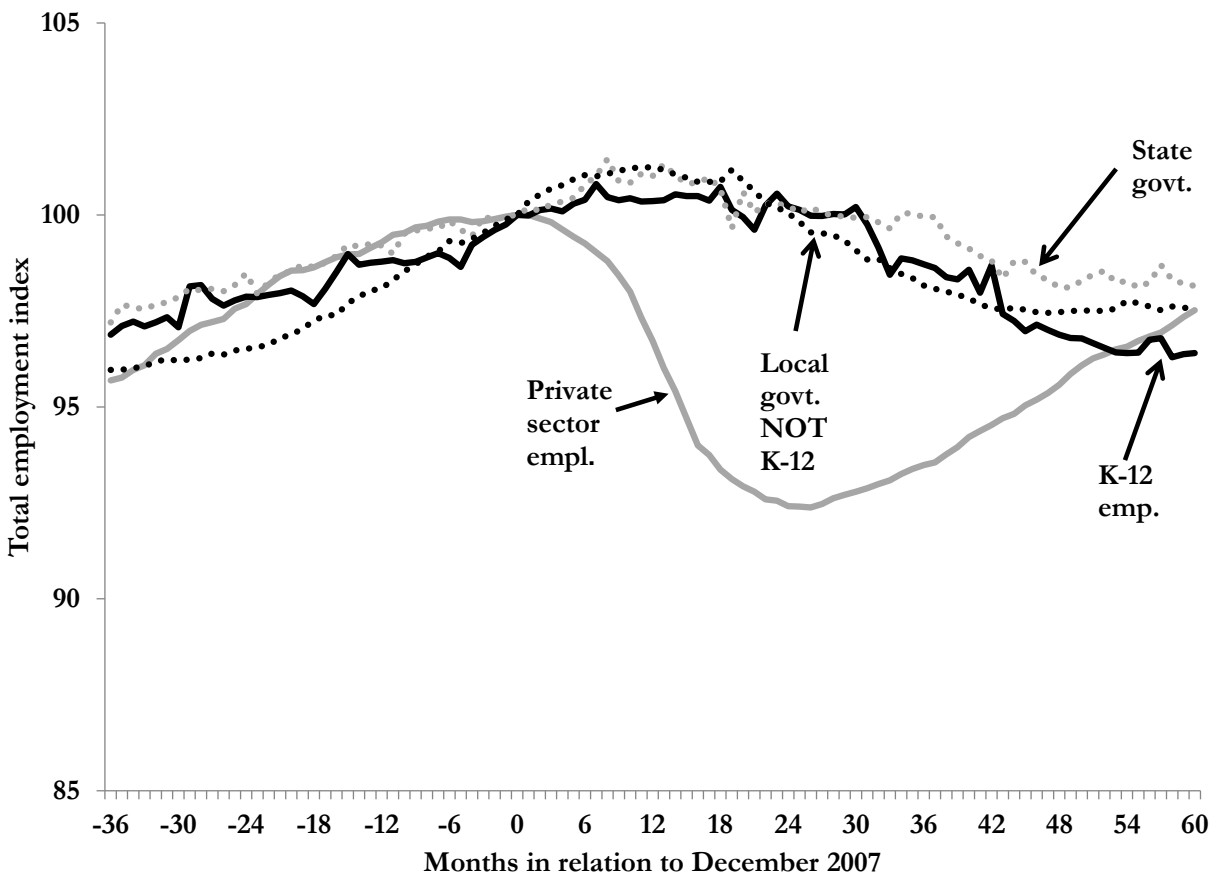BLS Current Employment Statistic (100 = Start of the Recession)

Figure 6
Teachers, Aids, Support Staff, and Other Education Employees,
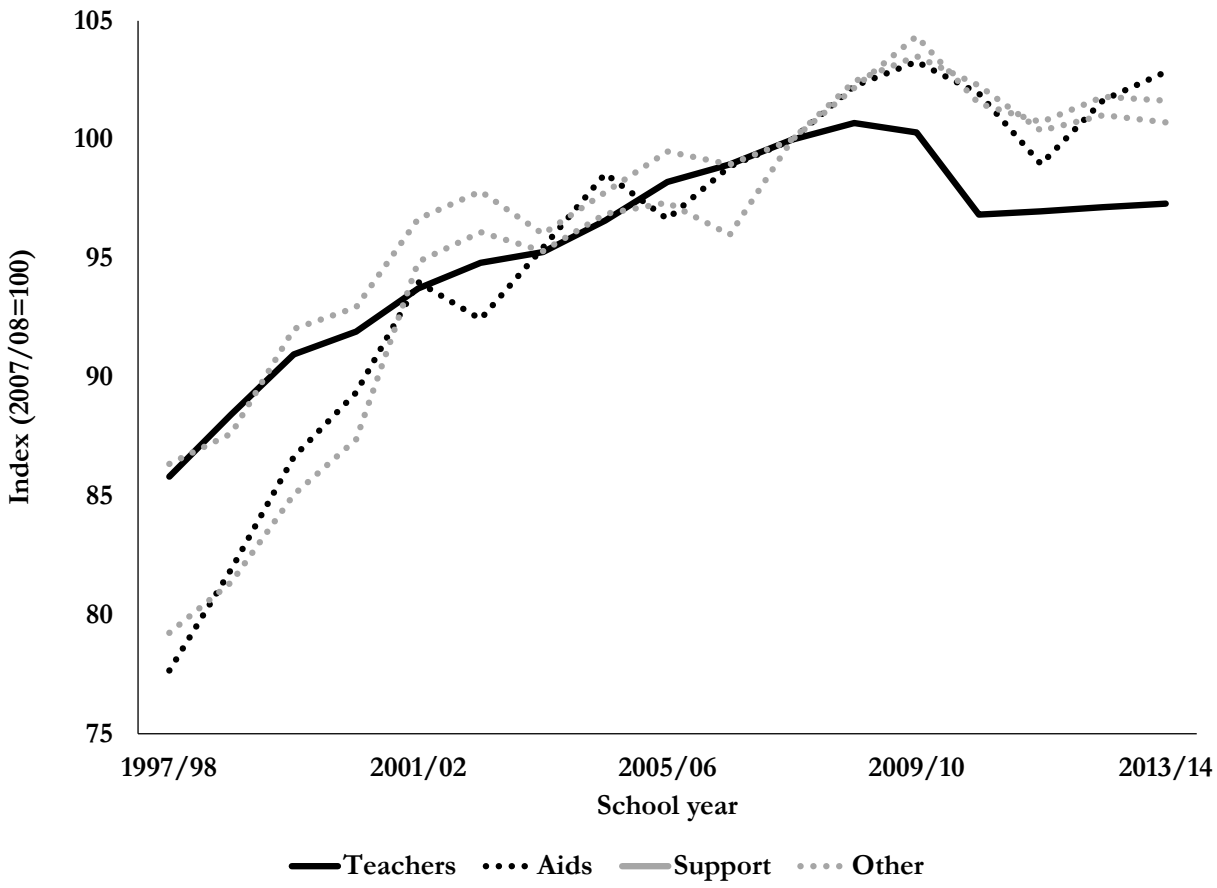1997/98 to 2013/14 School year (Index = 100 in 2007/08)

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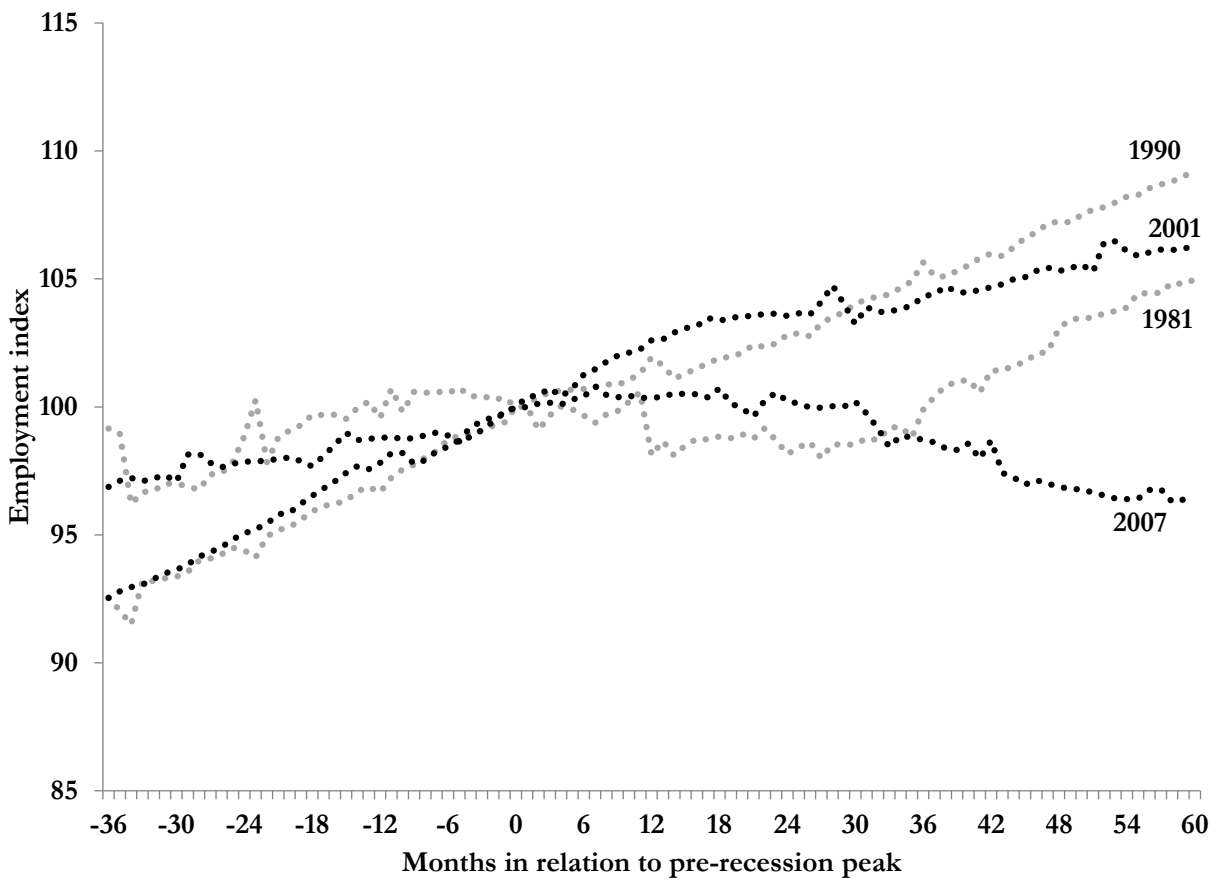BLS Current Employment Statistics (100 = Start of the Recession)

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