# Did Cuts in State Aid During the Great Recession Lead to Changes in Local Property Taxes?[1]

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Abstract

The Great Recession led to marked declines in state revenue. In this paper we investigate whether (and how) local school districts modified their funding and taxing decisions in response to state aid declines in the post-recession period. Our results reveal that school districts responded to state aid cuts in the post-recession period by countering these cuts. Relative to the pre-recession period, a unit decrease in state aid was associated with a relative increase in local funding. To further probe the school district role, we explore whether the property tax rate, which reflects decisions of districts facing budgetary needs, responded to state aid cuts. We find that relative to the pre-recession period, the post-recession period was characterized by a strong negative relationship between property tax rate and state aid per pupil. We also find important heterogeneities in these responses by region, property wealth, and importance of STAR revenue in district budget.

# 1 Introduction

The effects of the Great Recession on the U.S. economy were both widespread and dramatic. State and local governments were hit hard by the loss of income tax, property tax, and sales tax revenues that resulted from the recession. State and local governments generally provide the vast majority of public school funding, so the recession left schools especially vulnerable to funding losses. Chakrabarti and Livingston (2013a) finds that there were multi-year declines in state aid to education following the Great Recession. The objective of this paper is to study the interactions of state funding and local revenue and determine whether the relationship between the two changed in the post-recession period. More specifically, we examine whether the declines in state aid after the recession affected local districts' fund-raising behavior. Did local governments respond to cuts in state funding for education, and if so, how? Did they use local revenue and property taxes to counter the decline of state aid?

It is not necessarily clear *a priori* how the Great Recession and the resulting cuts in state aid would have affected local property taxes and revenues. On the one hand, school districts faced a shortfall in revenue from the state relative to what they normally received and they may have wanted to replace some of the lost state funds with local funds to avoid having to cut services. On the other hand, the decline in state aid came precisely when property values were plummeting, diminishing the tax base and making it harder to increase property tax revenues. Moreover, many people had lost their jobs, likely making them more averse to increased property taxes. Ultimately, how the recession affected the relationship between state aid and property taxes is an empirical one, and we aim to leverage our dataset to provide some insight in this paper.

More specifically, using a detailed district-level panel dataset of New York school districts, we investigate whether (and how) the Great Recession affected the relationship between state aid and property taxes. New York State is of interest for a variety of reasons. New York is the third largest state school system, serving 5.5% of the country's students.[5] Additionally, New York districts vary widely in terms of wealth, demographics, and urbanization.[6]

This paper builds on the literature studying school district funding,[7,8] but is more related to the literature that studies the impact of recessions on school district finances. Chakrabarti and Livingston (2013a, 2013b) analyze the impact of the Great Recession on school finances in New York and New Jersey respectively, and find that there were significant downward shifts from pre-recession trends in funding and expenditure. In addition, they find that, relative to corresponding pre-recession trends, both non-instructional and instructional expenditures declined sharply after the recession. New York was one of many states that cut education funding after the recession. A national analysis by the Center on Budget and Policy Priorities (Leachman and Mai (2013)) finds that even as of the 2013-14 school year, six years after the recession hit, 34 states provide less per-pupil funding than they did before the Great Recession. Even among states that increased funding in more recent years, the increases in state aid have not been enough to offset the funding losses experienced during the recession. There are many states (such as Wisconsin, California, and Texas) that experienced even more drastic declines in total funding per-pupil than New York.

[5] Authors' calculations using NCES CCD 2012 (http://nces.ed.gov/pubs2012/2012327.pdf)

[6] Because we focus on New York schools, it is important to note that these results apply specifically to New York, and may not necessarily be generalizable to other states. However, many of the issues that New York districts face are common across states, and so the results are still informative in the context of other states.

[7] See for example, Stiefel and Schwartz (2011), Rubenstein et al. (2007), Baker (2009), Duncombe and Yinger (2011) among others.

[8] Duncombe and Yinger (2000) provides an extensive documentation of property tax trends and policies. They find that over time there was a nationwide increase in property taxes as well as a significant increase in the cost of state and local government services that in turn caused an increase in education expenditures. They find that overall the real property tax burden per-capita increased by approximately one third from 1965 to 1996.

The paper most directly related to ours is Dye and Reschovsky (2008). It analyzes the effect of cuts in state aid resulting from the 2001 recession on property tax revenues raised by districts and local governments. They find that, on average, school districts increased property taxes by 23 cents for every dollar lost in state aid. However, Dye and Reschovsky find that the relationship between state aid and local property taxes varies a great deal across states—26 states had a positive correlation between yearly changes in state aid and property taxes from 1978-2000, including New York.

While this paper has been greatly informed by Dye and Reschovsky (2008) and builds on it, it differs in some key ways. One is the granularity of the data—while Dye and Reschovsky used state-level data, we exploit district-level data. We also have a longer panel spanning eight years (2005-2012), while the main analysis in Dye and Reschovsky contrasted school finance indicators between 2002 and 2004. The availability of a longer panel enables us to control for any pre-existing trends, as well as investigate whether the relationship changed with time after the post-recession period. Second, since we focus on one state in particular, we avoid the problem of having differential patterns across states masking the overall effect. Another fundamental difference is the period of analysis—the 2001 recession that Dye and Reschovsky analyze was far less severe than the Great Recession. Yet another important difference is that in addition to overall impacts, we leverage our district-level data to investigate whether there were heterogeneities in patterns by poverty and region—a line of inquiry that was not possible with state-level data in Dye and Reschovsky (2008). Finally, we employ a more rigorous estimation strategy. We start by utilizing district fixed effects estimation (FE) to control for time-invariant unobserved district characteristics that might affect the relationship. Next, to further eliminate any endogeneity problems, we pursue an instrumental variables estimation strategy (IV).

We find robust evidence that local revenue and property taxes responded to the decline in state aid following the recession. In the post-recession period, a unit decrease in state aid per pupil led to a *relative increase in both local revenue per pupil and property tax revenue per pupil in comparison to the pre-recession period*. More specifically, we find that in comparison to the pre-recession period, a dollar decrease in per pupil state aid led to a *relative increase* of 19 cents in local funding per pupil, and a *relative increase* of 14 cents in property tax revenue per pupil.[9]

To further investigate the role of local control, we explore whether changes in local revenue were associated with changes in the actual *property tax rate*. We find that relative to the pre-recession period, a decline in state aid per pupil led to a relative increase in property tax rates. We believe that by separately considering the tax rate we are able to determine whether the change in property tax revenue was a result of local tax policy decisions or simply changes in property values. As outlined above, we do find that districts changed their tax rates in response to state aid shifts.

In addition to analyzing overall local responses to changes in state funding, we also investigate whether there were heterogeneities in responses across regions, and by property wealth. We find interesting variations in the *extents of local responses* between wealthy and less property wealthy districts and between regions. In particular, the general pattern above -- that districts countered state aid cuts following the Great Recession with local and property tax revenue increases (relative to the pre-recession period) --  seems to stem mostly from the responses of the high wealth  districts. This is largely due to the interaction of state aid cuts with the existing STAR program. The STAR program operates like a matching grant, lowering voters'

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[9] These estimates are obtained from specifications that include school district fixed effects. Instrumental variables estimates—which are qualitatively similar—reveal that a dollar decrease in per pupil state aid led to a *relative increase* of 24 cents in local funding per pupil, and a *relative increase* of 20 cents in property tax revenue per pupil.

tax prices and thereby increasing their demand for education. High wealth districts benefited the most from STAR because of the matching grant nature of the program (Eom et al. forthcoming). In the aftermath of the Great Recession, the high wealth districts have been able to leverage the matching grant nature of STAR to replace traditional state aid with a combination of additional property tax revenues and state aid they receive as a result of STAR.

To further explore and understand the effects of the STAR program, we conduct a heterogeneity analysis based on the relative importance of STAR revenue in district budgets, and indeed find that the districts with the lowest share of STAR revenue have weaker responses to state aid changes after the recession. This indicates that there is some subsidizing effect of STAR that has encouraged districts, particularly the more wealthy districts, to increase local and property tax revenue in an effort to take advantage of the "matching grant" nature of STAR.

## 2      Background

## 2.1     Economic Background

The bursting of the housing bubble in 2007 and subsequent financial crisis led to a surge in unemployment and a decline in house prices. The rise in unemployment and fall of consumption meant less income and sales tax revenue for state governments, while the collapse of housing prices led to property tax revenue declines. New York's unemployment rate increased from 4.6% in 2006 to a peak of 8.5% in 2010. Since the peak in 2010, unemployment has fallen from its peak to 7.4% nationally and 7.5% in New York as of July 2013.[10] To counteract declines in state and local revenues, the federal government enacted the American Recovery and Reinvestment Act (ARRA, also known as the stimulus package), much of which was targeted at bolstering state and local government finances. However, most of the stimulus funds were used

[10] Source: Bureau of Labor Statistics/Haver Analytics.

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in the first two years after the recession. As the economic recovery stalled, many local governments faced fiscal tightening.

## 2.2     School Funding Overview

Funding for public schools comes from three main sources: federal aid, state aid, and local revenue. Out of these three sources, New York districts received approximately 3% of their funding from federal aid, 40% from state aid, and 57% from local revenue on average in the immediate pre-recession year (2008) (see Figure 1).[11] State aid and local revenue comprise the vast majority of school district funding, which makes schools vulnerable to fluctuations in state and local budgets. State aid is determined based on a variety of characteristics of the school districts, including enrollment, varying regional labor market costs, low-income students, limited English proficient students, and income wealth of the district.

Local revenue is composed primarily of residential and commercial property tax revenues.[12,13] The largest school districts (Buffalo, New York City, Rochester, Syracuse, and Yonkers) do not fund schools directly from property tax revenue; instead the schools are funded as part of the city's budget (of which property taxes are one component). Because of their different budgetary guidelines and processes, we exclude these five school districts from our analysis.

The school districts' fiscal years end on June 30th. In the spring (early April), before the next school fiscal year starts, the state passes its annual budget, which allocates, through a wide variety of programs and formulae, state aid for school districts. The school districts then draw up

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[11] In contrast, the national average in 2008 was 8% federal, 51% state, and 41% local.

[12] On average, in 2008 (the immediate pre-recession year) 72% of local revenue came from property taxes, with a standard deviation of 11.6%.

[13] The bulk of local revenue is constituted by real property taxes and assessments (76% in 2008) and STAR payments (12% in 2008). Other components include other real property tax items (such as payments in lieu of taxes, interest payments), sales and use tax revenue, charges for services (such as education fees, public safety fees, health fees, culture and recreation fees etc.), charges to other governments, earnings relating to use and sale of property, and other local revenue (such as fines, gifts etc.).

budgets and set their property tax rates to generate the amount of revenue needed to fund their operations. These are voted on[14] and the tax rates go into effect in September.[15] For a visual representation of the timing see Figure 2. This timing sequence—local budgets being set after state budgets are finalized—allows us to study the response of local revenue to changes in state aid.

## 2.3 The School Tax Relief Program (STAR)

Instituted in 1997, STAR is a homestead tax exemption program aimed at reducing homeowners' property taxes. STAR provides a state subsidy that pays for a portion of homeowners' school district property taxes. STAR is divided into two types: basic STAR, which is available to all homeowners whose primary residence is in New York, regardless of income or age, and enhanced STAR, which is available to homeowners age 65 or over with incomes below $79,050 (originally $60,000). Enhanced STAR took effect in the 1998-1999 school year. When it was implemented, enhanced STAR exempted $50,000 of property value; that exemption has since risen. Basic STAR was phased in over the course of three years starting in the 1999-2000 school year, with an exemption of $10,000, and reaching its final amount of $30,000 in 2002. In areas with relatively high property values (such as Westchester County) that exemption is multiplied by a sales price differential factor, so homeowners in those high-value counties receive much larger exemptions. Eom et. al. (forthcoming) examines New York's School Tax Relief Program (STAR) and finds that the state subsidy to property taxes resulted in increased property tax rates and spending. STAR is different from other state education spending in that its

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[14] School district budgets are voted on by annual referenda. Voters are mailed the relevant information, including the proposed budget and the estimated property taxes they would pay if the budget is approved (Rockoff (2010)).
[15] In 2011 the New York State Legislature enacted a law limiting the annual rate of change in the property tax rate, but this was not implemented until after our period of analysis. New York City and Nassau County both have existing limits on the rate of increase of assessed property values. New York City is excluded from our analysis (see section 2.2 for more details). To investigate whether the limit on assessed values in Nassau are contributing to our results, we re-estimate our specifications after excluding Nassau school districts. The results remain qualitatively very similar and are available on request.

benefits go primarily to wealthier districts—those with more homeowners and higher property values (Duncombe and Yinger (2000)). STAR is an important program in New York education finances because of its size—it applies to approximately three million taxpayers and provided several billion dollars in direct tax benefits.

While the importance of STAR in New York's school finance system is undeniable, it is important to note here that program was completely phased in well before the start of our period of analysis (2005-2012). But it is possible that the responses of school districts differed depending on the importance of STAR revenue in their budget. To further investigate what effect STAR may have had, we calculate the ratio of STAR revenue to state aid (which does not include STAR revenue), classify districts into quartiles based on their 2005 ratio, and conduct our analysis separately for these quartiles to see if the responses of districts varied across the four quartiles.

## 3    Data

We construct our school district panel by combining district financial report data with local property tax levy data, both from the New York Office of the State Comptroller. We obtain student racial demographic data and the percent of students eligible for free or reduced price lunch from the New York State Education Department. We include K-12 districts in our analysis; we exclude the "big five" districts (Buffalo, New York City, Rochester, Syracuse, and Yonkers) because their funding systems are different (see section 2.1). The resulting dataset covers 632 school districts spanning the 2004-05 to 2011-12 school years.[16]

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[16] For the remainder of the paper school years will be referred to using the year of the spring semester.

Our dataset includes data on state aid, federal funding, local revenue, property tax revenue, and the property tax rate (taxes per $1,000 of property value[17]). For our analysis, we express all financial variables in real 2012 dollars and per pupil terms.

In addition to analyzing these variables across all districts in the state, we delve deeper and look at heterogeneities by average property values, heterogeneities across different regions, and by the importance of STAR revenue in district budget. To study variation by property value, we construct quartiles based on districts' 2005 per-pupil property values and study any differences in responses across the four quartiles. To study spatial variations, we consider the "geographic regions" defined by the New York State Department of Labor. Figure 3 shows a map of the geographic regions. The Department of Labor defines ten regions; because of space constraints we study three that provide a good representation of different parts of New York--the Finger Lakes region captures much of the western part of New York, Central region captures the central part, while the Hudson Valley capture much of the Southern part of New York.[18] These regions are also of interest because they include some of the key metropolitan areas of New York (Syracuse, Rochester, and Westchester). The results for the other regions are qualitatively similar (and available on request). To study variation by the importance of STAR revenue in district budgets, we calculate the ratio of STAR payments to state aid in 2005 for each district, and divide them into quartiles based on that ratio. We then investigate whether there were differences in local responses across these quartiles.

## 4    Empirical Analysis

Using school district data from 2005 through 2012, we investigate whether the post-recession period was characterized by a different local revenue response to changes in state aid

[17] Property value refers to the equalized assessed value.
[18] Given space constraints, we chose to present results for regions in the east, south, and central over northern region (North County) as the latter region is considerably sparsely populated compared to the other nine regions.

relative to the pre-recession period. Specifically, did the state aid cuts prompted by the Great Recession lead districts to counter those cuts by increasing local revenue and/or property tax responses (relative to the pre-recession period)? It is worth noting here that our period of analysis, especially the start of our period of analysis, has a distinct advantage. Recall that the STAR program was enacted in 1997 and took full effect in 2002, so it was completely phased in before our period of analysis. Thus, in our analysis, STAR is part of the status quo, rather than a confounding factor. Moreover, controlling for pre-recession patterns (using pre-recession data for 2005-2008) allows us to control for effects of STAR. We further allay concerns about potential STAR effects by analyzing responses separately by STAR revenue quartiles (see section 4.3.3).

## 4.1    Examining the Relationship between State and Local sources of Funding

Table 1 presents summary characteristics of the various school finance and socioeconomic indicators used in this study in the immediate pre-recession year (2008). The average district received approximately $8,600 per-pupil in state aid in 2008, and raised approximately $12,000 per-pupil in local revenue, with $9,000 coming from property taxes. The average property tax rate was approximately 1.6% ($16 per $1,000 of property value).

We begin our analysis by examining the overall trends of our variables of interest. Figure 4 presents trend plots of the average state aid, property tax revenue, and local funding received by districts from 2005 to 2012, in per-pupil amounts. In the years leading up to the recession state aid, property tax revenue, and local funding were all on an upward trend. After 2009, state aid declined sharply as a result of the Great Recession. Coincidentally, and interestingly, trends in both property taxes and local revenue showed a notably steeper increasing trend since 2009, just as state aid started to fall, and this pattern continued until the end of our period (2012). From

these trend plots, it appears that local funding, through property taxes, may have increased in response to the decline in state aid. We explore this relationship more formally below.

Like most analyses of local public good provision, our analyses (and specifications below) are based on intuition derived from the median voter literature.[19] Under an assumption of single peakedness of preferences, the median voter model predicts that a majority rule voting system will select the outcome most preferred by the median voter – that is, the median voter will be pivotal in election outcomes. Our specification below captures the preference of the median voter; specifically we seek to understand the choice of the median voter facing a cut in state aid.

$$Y_{it} = \alpha_0 + \alpha_1 StateAid\_pp_{it} + \alpha_2 StateAid\_pp_{it} * Recession_t + \alpha_3 * FedAid\_pp_{it} + \alpha_4 X_{it} +$$
$$\alpha_5 Z_t + f_i + \varepsilon_{it} \quad (1)$$

Where $Y_{it}$ is a school finance indicator (local revenue per pupil, property tax revenue per pupil) for each school district $i$ in year $t$; $StateAid\_pp_{it}$ is the per-pupil state aid, $StateAid\_pp_{it}*Recession_t$ is the interaction of per-pupil state aid and a dummy indicating the recession, the latter equal to 0 before 2009 and 1 in 2009 and onward. Consistent with the median voter literature,[20] we control for other intergovernmental grants[21]; $FedAid\_pp_{it}$ represents the amount of per-pupil funding coming from federal aid. Given intergovernmental grants (state aid per pupil and federal aid per pupil), the median voter chooses $Y_{it}$. $X_{it}$ represents the vector of school district demographic characteristics (racial composition and the percentage of students

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[19] See for example,  Ross and Yinger (1999), Fletcher and Kenny (2008), Brunner and Ross (2010), Corcoran and Evans (2010), Wang, et.al. (2011), and Boustan et.al. (2013), among others.
[20] See for example, Corcoran and Evans (2010).
[21] For impacts of intergovernmental grants on educational expenditure, see Tsang and Levin (1983).

eligible for free or reduced price lunch), and the percent of district funding coming from state aid. As in Dye and Reschovsky (2008), we include the share of revenue from state aid because the responses of districts that are more dependent on state aid will likely be different from districts that are less dependent. $Z_t$ is a vector of year dummies, and $f_i$ denotes district fixed effects. All financial variables are inflation-adjusted to constant 2012 dollars. All regressions use robust standard errors that are adjusted for clustering by school districts.

Our dataset includes STAR payments as part of local revenue, and importantly, not as part of state aid.[22] Thus, changes in state aid are determined solely by the state, not by local districts changing their property tax rates.

The results from estimation of specification (1) are presented in Table 2. Looking at column 1, while state aid per-pupil had a positive relationship with local funding prior to the recession, that relationship weakened after the recession. We find similar results for property tax revenue (column 2). This indicates that local governments responded by countering changes in state funding with changes in local funding after the recession hit.

To further understand the relationship, we split the recession interaction into individual year interactions to study the effects separately in each post-recession year. If the negative relationship we found in the first specification occurs in only some of the post-recession years that will be revealed in a more flexible specification such as specification (2) below, which allows the effect to vary across the different post-recession years. Distinguishing between individual year effects also allows us to investigate whether the relationship changed over years in the post-recession period. The specification is as follows:

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[22]This is in keeping with the accounting method used in our data source (the New York State Comptroller's Office).

$$Y_{it} = \beta_0 + \beta_1 StateAid\_pp_{it} + \beta_2 StateAid\_pp_{it} * 2009 + \beta_3 StateAid\_pp_{it} * 2010 +$$

$$\beta_4 StateAid\_pp_{it} * 2011 + \beta_5 StateAid\_pp_{it} * 2012 + +\beta_6 FedAid\_pp_{it} + \beta_7 X_{it} + \beta_8 Z_t +$$

$$f_i + \varepsilon_{it} \qquad (2)$$

In this model, the coefficient on state aid per pupil captures the relationship between state aid per pupil and local revenue per pupil during the pre-recession period. The coefficients $\beta_2$ to $\beta_5$ capture the changes (if any) in this relationship in each of the post-recession years.

The results are presented in columns 3 and 4 of Table 2. Each post-recession interaction year has a negative coefficient, and each of them is statistically different from zero. The magnitudes are smaller than the pre-recession coefficient on state aid per pupil, which indicates that in the post-recession years local revenue per pupil would still decline as state aid per pupil declined, but it would do so less strongly than it would have before the recession.

These results imply that although during the post-recession period a unit decline in state aid per pupil would still be associated with a decline in local revenue per pupil (and property tax revenue per pupil), the extent of the latter declines were markedly smaller. In other words, it seems that the local government responded to cuts in state aid by increasing the local funding effort, compared to the pre-recession period.

**4.2    Investigating the Relationship between State Aid and the Property Tax Rate**

To explore whether the changes in property tax revenue we observed earlier were related to changes in the property tax rates, we next investigate the impacts of change in state aid on them. In particular, we want to see whether the patterns above were associated with relative increases in property tax rates in the post-recession period.

The trend graph in Figure 5 plots the property tax rate, which shows a sharp decline leading up to the recession, and then an equally sharp increase after 2010, which points to a potential response to the downward movement of state aid. Next, we investigate the relationship between state aid per pupil and property tax rate more formally, using specifications (3) and (4) below.

$$TaxRate_{it} = \gamma_0 + \gamma_1 StateAid\_pp_{it} + \gamma_2 StateAid\_pp_{it} * Recession_t + \gamma_3 FedAid\_pp_{it} +$$
$$\gamma_4 PropertyValue\_pp_{it} + \gamma_5 X_{it} + \gamma_6 Z_t + f_i + \varepsilon_{it} \quad (3)$$

$$TaxRate_{it} = \delta_0 + \delta_1 StateAid\_pp_{it} + \delta_2 StateAid\_pp_{it} * 2009 + \delta_3 StateAid\_pp_{it} * 2010$$
$$+ \delta_4 StateAid\_pp_{it} * 2011 + \delta_5 StateAid\_pp_{it} * 2012 + \delta_6 FedAid\_pp_{it}$$
$$+ \delta_7 PropertyValue\_pp_{it} + \delta_8 X_{it} + \delta_9 Z_t + f_i + \varepsilon_{it} \quad (4)$$

This analysis also draws on the median voter literature—given intergovernmental revenues (state aid and federal aid), the property tax rate choice of the median voter depends on the assessed value of property. Therefore, in specifications (3) and (4), we include (assessed) property value per pupil as an additional regressor. Specification (3) constrains the post-recession tax rate response (to a decline in state aid per pupil) to vary linearly with time. In contrast, specification (4) estimates a more flexible specification where the property tax rate impacts are allowed to vary non-linearly over the various post-recession years.

The results of this analysis are presented in Table 3. They reveal that prior to the recession state aid had a positive relationship with the tax rate; after the recession that relationship diminished sharply. Decomposing the recession interaction into separate year interactions (column 2), we see that the pattern holds for each post-recession year, and in fact the

substitution grew stronger over each year. In other words, the results reveal that facing state aid cuts following the Great Recession, the districts responded with relative increases in the property tax rate (in comparison to the pre-recession period), in an effort to counter the declines in state aid. [23, 24] The table also shows that (as might be expected), an increase in property value per pupil is associated with a decrease in tax rates, and vice versa. This negative relationship continues to hold in rest of the paper, and in most cases (unlike in Table 3) the relationship is statistically significant.

To sum, the results in Tables 2 and 3 show that in the aftermath of the Great Recession, districts facing state aid cuts responded with relative increases in local revenues, and in the property tax rate. While this is the aggregate picture, different groups of districts may have responded differently - we next investigate if, among other factors, differences in property wealth and importance of STAR mattered in the extent of offsets the districts were able to make.

## 4.3 Were There Heterogeneities in Local Response to Declines in State Aid?

In addition to looking at how changes in state aid affected changes in local funding across all districts in the state, we dive deeper and examine whether there were variations in local responses by district property value (or wealth) and across districts in different regions of the state. Moreover, to understand how STAR interacted with property tax and local revenue

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[23] Note that while fixed effects control for district specific time-invariant attributes, there may be endogeneity problems caused by unobserved time-varying characteristics that are correlated with local revenue and state aid. To address this endogeneity, we implement an instrumental variables (IV) strategy, using the four-year lag of state aid per-pupil as the instrument for state aid per pupil. The IV results remain qualitatively similar to each of the corresponding fixed effects results reported in the paper; to save space we only report IV results corresponding to tables 2 and 3 in appendix tables A1 and A2. The other IV results are available on request.

[24] There may be cause for concern in estimations of (3) and (4) if the property value is endogenous. To address this potential issue, we carry out two alternative estimations using *pre-recession data on property values*. In the first strategy (following Chakrabarti and Roy (2012)), we use 2005 property value (the first year available in our data) and interact it with year dummies to get variation over time—the purpose is to obtain a measure of property value that is exogenous. The second strategy is based on the same intuition, but uses 2008 property value and its interactions with year dummies (note that 2008 is the immediate pre-recession year). The results from these two strategies (not presented here, but available on request) mirror closely those obtained above, giving us further confidence in these results.

responses of districts, we conduct a heterogeneity analysis based on the relative importance of STAR revenue in district budgets.

### 4.3.1 Heterogeneities by Property Values

Based on the median voter theorem, one would expect the responses of higher income or property wealthy districts to differ from lower income or property poor districts. High property wealth districts contain more wealthy families and a wealthier median voter who would have a higher demand for education, and hence a higher propensity to counter any state aid cuts. Moreover, property wealthy districts also have the means to provide for more revenues at a lower cost to them, by virtue of having a higher property tax base.

One would expect STAR to play a role here too. As Eom et al. (forthcoming) points out, STAR acts as a matching grant lowering voters' tax prices. Because of this, one would expect a higher tax rate response in districts with higher property value wealth because the same tax rate increase yields a larger dollar increase in property tax revenue, some of which is reimbursed by the state through STAR. Additionally, STAR is adjusted up by the sales price differential factor (SPDF) in counties where the median home sale prices exceeds the statewide median sales price (i.e., the higher property value districts).

In Table 4 we present results for our local revenue and property tax regressions where we allow the impacts to vary by the property wealth of the district. We divide districts into quartiles based on their per-pupil property values in 2005 (the first year of our panel). We find that the wealthiest districts have the largest negative post-recession relationship (relative to the pre-program period), indicating that they offset cuts in state aid more than poorer districts. This pattern is consistent with our discussion above. The more wealthy districts have a higher demand for education, have the means to tax themselves more, and receive more money from STAR---

these factors have likely led to larger offsets of state aid cuts (by local and property tax funding) in these districts. Meanwhile, the responses of the less wealthy districts are smaller, both economically and statistically. These districts may not have had the resources to counter state aid cuts as much. There is still some evidence of offsets, but these offsets are smaller than those in the wealthier districts.

A similar pattern is borne out in the tax rate results in Table 5. Relative to the pre-recession period, the wealthier districts increased their tax rates considerably more after the recession to compensate for state aid declines.

To summarize the results so far, the overall patterns in Tables 2 and 3 show that in the post-recession period districts facing state aid cuts responded with relative increases in local funding and in the property tax rate. The findings in Tables 4 and 5 reveal that these patterns were driven primarily by the high wealth districts. It appears that the high wealth districts were able to take advantage of the matching grant nature of STAR to replace traditional state aid with a combination of additional property tax revenues and state aid they received as a result of STAR. In other words, the residents of wealthy districts were able to leverage a unique aspect of New York's school finance system to replace, at least partially, one form of state aid with a second, indirect form of state aid. Residents of poorer districts, where the matching rate is lower, did not respond in the same way.

### 4.3.2 Heterogeneities by Regions

New York is a large and very diverse state, and districts in different areas may have faced different situations following the recession. We examine heterogeneities in our results across a few key regions of the state—the Central region, the Finger Lakes region, and the Hudson Valley

region (see section 3 for more details). These results are presented in Tables 6 and 7. We see that the Hudson Valley school districts had a stronger negative post-recession relationship between state aid and property tax revenue than the other two regions did—in other words, a unit fall in state aid per pupil after the recession led to a larger increase in property tax revenue in Hudson Valley region than the other two regions. This may be because the Hudson Valley, which includes Westchester County, is in general wealthier than the more rural Central and Finger Lakes regions. However, none of the differences in coefficients across the regions are statistically significant. Results in Table 7 reveal that the decline in state aid was countered by increases in local tax rates in all three regions. Of note is that the tax rate changes were not statistically different between these regions.

Thus, all of these regions follow the same general pattern that the overall sample follows. This indicates that the effects of the recession and responses were not concentrated just in one part of the state, but were widespread.

### 4.3.3   Heterogeneities by STAR Revenue Shares

Because the STAR program explicitly subsidizes districts that increase property taxes and property tax revenue, we might expect to see different responses in districts where STAR revenue plays a larger role in their budget. To test this, we calculate the ratio of STAR revenue to state aid in each district and classify districts into quartiles based on their ratio in 2005 (the highest quartile representing the districts with the largest STAR to state aid ratio). We then estimate our model of district response separately for each quartile.

These results are presented in Tables 8 and 9. Looking at Table 8, the bottom quartile (those with the least STAR revenue relative to state aid) had a weaker pre-recession relationship between state aid and local revenue (or property tax revenue) than the other quartiles, indicating

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less willingness or ability to increase local revenue or property taxes as state aid was increasing. Furthermore, their post-recession response (relative to the pre-recession period) is statistically insignificant, whereas the other three quartiles have both economically and statistically significant compensatory local and property tax revenue responses to post-recession cuts in state aid. We see the strongest post-recession response in the highest quartile. This is possibly due to a combination of factors---they enjoy greater STAR subsidies, they likely have higher assessed values so a given tax rate yields higher property tax revenue, they have a higher demand for education, and they have the means to tax themselves more.

A similar pattern plays out in the tax rate response (Table 9), where the bottom quartile does not show any statistically significant tax rate response in the post-recession period, although the coefficients are still negative. The top three quartiles have economically much stronger post-recession responses that are statistically significant in most cases.

## 5    Conclusion

In this paper, we analyzed how the Great Recession changed the relationship between state aid and local revenues in New York, specifically looking at how changes in state aid before and after the recession had varying impacts on local revenue and property taxes. This analysis furthers our understanding of how districts make spending decisions given changes in their funding sources.

Our analysis uncovered some interesting patterns. We find that the relationship between state aid per pupil and local revenue (or property tax revenue) changed markedly with the Great Recession. The post-recession era was characterized by local governments proactively increasing taxes (relative to that in the pre-recession period) for a decrease in state aid per pupil. More specifically, relative to the pre-recession period, a dollar decline in state aid resulted in a 14 cent increase in property tax revenue and a 19 cent increase in local revenue. By allowing the effects

of state aid to vary across years, we find that this pattern is not driven by a single year effect, but is a consistent pattern reflected in each year after the recession.

By separately analyzing the driver of property tax revenue—the property tax rate—we find that changes in state aid per-pupil consistently affected the tax rate, suggesting that districts did respond to changes in state aid. In addition, the compensatory relationship became stronger over the years.

Our analysis above reveals an important role of property taxes in school finance. We find that property taxes acted as a stabilizing force—school districts facing cuts in state funding responded by countering these state aid cuts through increased property taxes. But there were important variations in the responses of school districts. Investigating whether the response to state aid cuts varied with property value, we find that wealthier districts raised property tax rate by more following the recession and raised greater funds through local and property tax revenue. We argue that this pattern relates to the STAR program – being essentially a matching grant, STAR allowed high wealth districts to increase their spending at a relatively lower cost to themselves. Residents of poorer districts, where the matching rate was lower, do not seem to have responded in the same way. The importance of STAR is also brought out when, to investigate whether the local responses varied by the importance of STAR revenue in districts' budgets, we classify districts into four quartiles based on the ratio of their STAR revenue to their state aid. Our results show that districts in the highest quartile had the strongest compensatory local and property tax revenue responses facing state aid cuts in the post-recession period, while the districts in the lowest quartile had the weakest responses. This underscores the fact that all of the elements of a state's school finance system matter and that, particularly in downturns, elements of the system that have disequalizing effects can serve to accentuate existing

inequalities. Finally, analyzing variations by region, we find that the effect was qualitatively similar across regions, with a somewhat stronger relationship between state aid and property tax revenue in Hudson Valley.

Thus, we find robust evidence that state aid does affect local decision-making when it comes time to set budgets. The findings of this study have the potential to inform policy decisions at the state and local level. The state's decisions about how much to spend on education during fiscal crises clearly has an effect on not just state funding for education, but also on local revenue decisions. Policymakers need to keep that response in mind when planning education financing. New York was not alone in its substantial declines in education spending following from the Great Recession. State aid has not returned to pre-recession levels in the majority of states (including other northeastern states such as Pennsylvania and Maine). Consequently, school funding depended to a much greater extent on property taxes. Our results for New York show that local governments responded by countering the state aid cuts and replenishing some of the lost funds. However, the local revenue offsets were substantially smaller than the actual state funding declines. This phenomenon of incomplete offsets  is likely to put pressure on funding and spending in schools. In addition, because property taxes are unpopular politically, several recent laws such as New York's property tax rate cap (that went into effect in the 2012-13 school year) have limited the ability of districts to raise local funds through increasing property tax rates. These would further intensify pressure on districts trying to adequately fund K-12 education.

# References

Baum, C.F., Schaffer, M.E., Stillman, S. (2010), "ivreg2: Stata module for extended instrumental variables/2SLS, GMM and AC/HAC, LIML and k-class regression," http://ideas.repec.org/c/boc/bocode/s425401.html.

Boustan, L., Ferreira, F., Winkler, H., & Zolt, E. M. (2013). The Effect of Rising Income Inequality on Taxation and Public Expenditures: Evidence from U.S. Municipalities and School Districts, 1970–2000. Review of Economics and Statistics, 95(4), 1291–1302.

Bruce D. Baker (2009), "Within District Resource Allocation and the Marginal Costs of Providing Equal Educational Opportunity: Evidence from Texas and Ohio," *Education Policy Analysis Archives* 17, no. 3:1–31.

Brunner, E. J., & Ross, S. L. (2010). Is the median voter decisive? Evidence from referenda voting patterns. Journal of Public Economics, 94(11-12), 898–910.

Chakrabarti, Rajashri and Max Livingston (2013a), "The Long Road to Recovery: New York Schools in the Aftermath of the Great Recession," *Federal Reserve Bank of New York Staff Report*, no. 631.

Chakrabarti, Rajashri and Max Livingston (2013b), "Still Not Out of the Woods? New Jersey Schools during the Recession and Beyond," *Federal Reserve Bank of New York Staff Report*, no. 632.

Chakrabarti, Rajashri and Joydeep Roy (2014), "Do Charter Schools Crowd Out Private School Enrollment? Evidence from Michigan," *Federal Reserve Bank of New York Working Paper*.

Duncombe, William and John Yinger (1998), "School Finance Reform: Aid Formulas and Equity Objectives." 1998. *National Tax Journal* 51 (2) (June): 239-262.

Duncombe, William and John Yinger (2000), "Alternative Paths to Property Tax Relief," Syracuse University Working Paper.

Duncombe, William and John Yinger (2011), "Making Do: State Constraints and Local Responses in California's Education Finance System." *International Tax and Public Finance* 18 (3) (June): 337-368.

Dye, Richard and Andrew Reschovsky (2008), "Property Tax Responses to State Aid Cuts in the Recent Fiscal Crisis", Public Budgeting & Finance 28 (2), 87-111.

Eom, Tae Ho, Duncombe, William, and John Yinger. (Forthcoming), "The Unintended Consequences of Property Tax Relief: New York's STAR Program." Education Finance and Policy.

Fletcher, D., & Kenny, L. W. (2008). The Influence of the Elderly on School Spending in a Median Voter Framework. Education Finance and Policy, 3(3), 283–315.

The New York State Council of School Superintendents (2011), "At the Edge: A Survey of New York State School Superintendents on Fiscal Matters." New York State Council of School Superintendents, Albany, New York.

Rockoff, Jonah E. 2010. Local Response to Fiscal Incentives in Heterogeneous Communities. *Journal of Urban Economics* 68(2): 138-147.

Ross, Stephen and John Yinger. 1999. Sorting and voting: a review of the literature on urban public finance. In Handbook of Regional and Urban Economics vol. 3, edited by Ceshire, Paul, Mills, Edwin S. North-Holland, Amsterdam.

Ross Rubenstein et al., (2007), "From Districts to Schools: The Distribution of Resources across Schools in Big City School Districts," Economics of Education Review 26, no. 5: 532–545.

Stiefel, Leanna and Schwartz, Amy Ellen (2011), "Financing K-12 Education in the Bloomberg Years, 2002-2008," Education Reform in New York City, 55-86.

Tsang Mun and Henry Levin (1983), "The Impact of Intergovernmental Grants on Educational Expenditure", Review of Educational Research, 53(3), 329-367.

The State Education Department, Office of State Aid, "State Aid Handbook, various years" Albany, New York.

Wang, W., Duncombe, W.D., and John M. Yinger. School district responses to matching aid programs for capital facilities: A case study of New York's building aid program. National Tax Journal, September 2011, 64 (3), 759–794.

**Table 1: Summary Statistics in the Immediate Pre-Recession Year (2008)**

|  | Mean | Median | 25$^{th}$ Percentile | 75$^{th}$ Percentile |
|---|---|---|---|---|
| Federal Aid Per Pupil | 708.13 | 541.27 | 376.04 | 765.69 |
|  | (1569) |  |  |  |
| State Aid Per Pupil | 8,597.27 | 8,683.90 | 5,798.19 | 11,476.62 |
|  | (3884.8) |  |  |  |
| Local Funding Per Pupil | 12,226.38 | 9,580.52 | 7,018.56 | 15,130.79 |
|  | (7946.68) |  |  |  |
| Property Tax Revenue Per Pupil | 9,230.18 | 6,798.52 | 4,571.52 | 12,147.69 |
|  | (6762.48) |  |  |  |
| Tax Rate (per $000) | 16.45 | 16.41 | 13.40 | 19.60 |
|  | (4.85) |  |  |  |
| % Black | 5.29 | 2.00 | 1.00 | 4.00 |
|  | (10.16) |  |  |  |
| % Hispanic | 5.68 | 2.00 | 1.00 | 6.00 |
|  | (9.63) |  |  |  |
| % Asian | 2.31 | 1.00 | 1.00 | 2.00 |
|  | (3.81) |  |  |  |
| % Am. Indian | 0.55 | 0.00 | 0.00 | 0.00 |
|  | (3.5) |  |  |  |
| % Free/Reduced Lunch | 29.18 | 30.00 | 14.00 | 41.00 |
|  | (17.1) |  |  |  |
| % State Aid | 42.09 | 44.88 | 28.15 | 58.15 |
|  | (19.15) |  |  |  |
| Property Value Per-Pupil ($000) | 938.42 | 500.42 | 310.55 | 993.45 |
|  | (2188.8) |  |  |  |
| Observations | 628 |  |  |  |

Note: All financial variables are inflation adjusted to 2012 dollars.

**Table 2: Did Property Tax Revenue and Local Revenue Respond to State Aid Cuts During the Great Recession?**
**(Using School District Fixed Effects)**

|  | Local Funding Per Pupil FE | Property Tax Revenue Per Pupil FE | Local Funding Per Pupil FE | Property Tax Revenue Per Pupil FE |
|---|---|---|---|---|
|  | (1) | (2) | (3) | (4) |
| State Aid Per Pupil | 1.04*** | 0.45*** | 1.05*** | 0.45*** |
|  | (0.31) | (0.11) | (0.31) | (0.11) |
| State Aid PP * Recession | -0.19*** | -0.14*** |  |  |
|  | (0.04) | (0.02) |  |  |
| State Aid PP * 2009 |  |  | -0.15*** | -0.12*** |
|  |  |  | (0.05) | (0.02) |
| State Aid PP * 2010 |  |  | -0.23*** | -0.16*** |
|  |  |  | (0.05) | (0.02) |
| State Aid PP * 2011 |  |  | -0.19*** | -0.14*** |
|  |  |  | (0.04) | (0.02) |
| State Aid PP * 2012 |  |  | -0.20*** | -0.15*** |
|  |  |  | (0.04) | (0.02) |
| Observations | 5072 | 5072 | 5072 | 5072 |
| $R^2$ | 0.98 | 0.99 | 0.98 | 0.99 |

Notes: *, **, *** denote statistical significance at the 10, 5, and 1% level, respectively. Robust standard errors adjusted for clustering by school district are in parentheses. All regressions include year fixed effects, racial composition, the percent of students eligible for free or reduced price lunch, per-pupil federal aid, and the percent of district funding from state aid. All financial variables are expressed in real terms. See specifications (1)-(2) in the text.

**Table 3: Did Property Tax Rates Respond to State Aid Cuts During the Great Recession?**

| | FE | |
|---|---|---|
| | Tax Rate | Tax Rate |
| | (1) | (2) |
| State Aid Per Pupil | 0.00035*** | 0.00035*** |
| | (0.000) | (0.000) |
| State Aid PP * Recession | -0.00025*** | |
| | (0.000) | |
| State Aid PP * 2009 | | -0.00014*** |
| | | (0.000) |
| State Aid PP * 2010 | | -0.00023*** |
| | | (0.000) |
| State Aid PP * 2011 | | -0.00030*** |
| | | (0.000) |
| State Aid PP * 2012 | | -0.00035*** |
| | | (0.000) |
| Property Value PP ($000) | -0.00076 | -0.00071 |
| | (0.001) | (0.000) |
| Observations | 5057 | 5057 |
| $R^2$ | 0.93 | 0.93 |

Notes: *, **, *** denote statistical significance at the 10, 5, and 1% level, respectively. Robust standard errors adjusted for clustering by school district are in parentheses. All regressions include year fixed effects, racial composition, the percent of students eligible for free or reduced price lunch, per-pupil federal aid, and the percent of district funding from state aid. All financial variables are expressed in real terms. See specifications (3)-(4) in the text.

**Table 4: Studying Heterogeneity by Property Value: Did Property Tax Revenue and Local Revenue Responses Vary by District Property Values?**

| | Local Funding Per Pupil FE (1) | Property Tax Revenue Per Pupil FE (2) | Local Funding Per Pupil FE (3) | Property Tax Revenue Per Pupil FE (4) |
|---|---|---|---|---|
| | First Quartile | | | |
| State Aid Per Pupil | 0.44*** | 0.15*** | 0.45*** | 0.15*** |
| | (0.06) | (0.06) | (0.05) | (0.05) |
| State Aid PP * Recession | -0.07*** | -0.02 | | |
| | (0.01) | (0.02) | | |
| State Aid PP * 2009 | | | -0.09*** | -0.02 |
| | | | (0.01) | (0.02) |
| State Aid PP * 2010 | | | -0.10*** | -0.03 |
| | | | (0.03) | (0.02) |
| State Aid PP * 2011 | | | -0.05*** | -0.01 |
| | | | (0.02) | (0.02) |
| State Aid PP * 2012 | | | -0.06** | -0.01 |
| | | | (0.02) | (0.02) |
| Observations | 1263 | 1263 | 1263 | 1263 |
| R$^2$ | 0.98 | 0.95 | 0.98 | 0.95 |
| | Second Quartile | | | |
| State Aid Per Pupil | 1.34** | 0.23*** | 1.32** | 0.23*** |
| | (0.64) | (0.09) | (0.62) | (0.08) |
| State Aid PP * Recession | -0.07 | -0.00 | | |
| | (0.09) | (0.02) | | |
| State Aid PP * 2009 | | | -0.22 | -0.03 |
| | | | (0.14) | (0.02) |
| State Aid PP * 2010 | | | -0.07 | -0.00 |
| | | | (0.09) | (0.02) |
| State Aid PP * 2011 | | | 0.01 | 0.00 |
| | | | (0.10) | (0.02) |
| State Aid PP * 2012 | | | 0.01 | 0.02 |
| | | | (0.11) | (0.03) |
| Observations | 1264 | 1264 | 1264 | 1264 |
| R$^2$ | 0.74 | 0.95 | 0.75 | 0.95 |
| | Third Quartile | | | |
| State Aid Per Pupil | 1.11*** | 0.81*** | 1.14*** | 0.84*** |
| | (0.07) | (0.07) | (0.07) | (0.07) |
| State Aid PP * Recession | -0.09*** | -0.06*** | | |
| | (0.01) | (0.01) | | |
| State Aid PP * 2009 | | | -0.14*** | -0.11*** |
| | | | (0.01) | (0.02) |
| State Aid PP * 2010 | | | -0.10*** | -0.06*** |
| | | | (0.01) | (0.01) |
| State Aid PP * 2011 | | | -0.06*** | -0.03* |
| | | | (0.02) | (0.02) |
| State Aid PP * 2012 | | | -0.05** | -0.02 |
| | | | (0.02) | (0.02) |
| Observations | 1264 | 1264 | 1264 | 1264 |
| R$^2$ | 0.98 | 0.98 | 0.98 | 0.98 |
| | Fourth Quartile | | | |
| State Aid Per Pupil | 2.24*** | 1.79*** | 2.23*** | 1.78*** |
| | (0.32) | (0.37) | (0.33) | (0.37) |
| State Aid PP * Recession | -0.33*** | -0.28*** | | |
| | (0.07) | (0.07) | | |
| State Aid PP * 2009 | | | -0.26*** | -0.24*** |
| | | | (0.06) | (0.07) |
| State Aid PP * 2010 | | | -0.29*** | -0.25*** |
| | | | (0.05) | (0.06) |
| State Aid PP * 2011 | | | -0.37*** | -0.30*** |
| | | | (0.10) | (0.09) |
| State Aid PP * 2012 | | | -0.41*** | -0.38*** |
| | | | (0.12) | (0.12) |
| Observations | 1265 | 1265 | 1265 | 1265 |
| R$^2$ | 0.97 | 0.97 | 0.97 | 0.97 |

Notes: *, **, *** denote statistical significance at the 10, 5, and 1% level, respectively. Robust standard errors adjusted for clustering by school district are in parentheses. All regressions include year fixed effects, racial composition, the percent of students eligible for free or reduced price lunch, per-pupil federal aid, and the percent of district funding from state aid. All financial variables are expressed in real terms. The first quartile represents the districts with the lowest per-pupil property values. See specifications (1)-(2) in the text.

**Table 5: Studying Heterogeneity by Property Value: Did Property Tax Rate Response Vary by District Property Values?**

|  | FE | |
|---|---|---|
|  | Tax Rate | Tax Rate |
|  | (1) | (2) |
| **First Quartile** | | |
| State Aid Per Pupil | 0.00032* | 0.00032* |
|  | (0.00017) | (0.00017) |
| State Aid PP * Recession | 0.00003 | |
|  | (0.00006) | |
| State Aid PP * 2009 | | 0.00001 |
|  | | (0.00006) |
| State Aid PP * 2010 | | 0.00004 |
|  | | (0.00007) |
| State Aid PP * 2011 | | 0.00007 |
|  | | (0.00006) |
| State Aid PP * 2012 | | -0.00001 |
|  | | (0.00008) |
| Property Value PP ($000) | -0.02772*** | -0.02779*** |
|  | (0.00515) | (0.00505) |
| Observations | 1262 | 1262 |
| $R^2$ | 0.95 | 0.95 |
| **Second Quartile** | | |
| State Aid Per Pupil | 0.00044** | 0.00043** |
|  | (0.00021) | (0.00021) |
| State Aid PP * Recession | 0.00000 | |
|  | (0.00005) | |
| State Aid PP * 2009 | | -0.00006 |
|  | | (0.00005) |
| State Aid PP * 2010 | | 0.00001 |
|  | | (0.00005) |
| State Aid PP * 2011 | | 0.00003 |
|  | | (0.00005) |
| State Aid PP * 2012 | | 0.00005 |
|  | | (0.00006) |
| Property Value PP ($000) | -0.02748*** | -0.02759*** |
|  | (0.00229) | (0.00229) |
| Observations | 1264 | 1264 |
| $R^2$ | 0.96 | 0.96 |
| **Third Quartile** | | |
| State Aid Per Pupil | 0.00143*** | 0.00148*** |
|  | (0.00018) | (0.00017) |
| State Aid PP * Recession | -0.00012*** | |
|  | (0.00004) | |
| State Aid PP * 2009 | | -0.00020*** |
|  | | (0.00003) |
| State Aid PP * 2010 | | -0.00011*** |
|  | | (0.00003) |
| State Aid PP * 2011 | | -0.00008 |
|  | | (0.00005) |
| State Aid PP * 2012 | | -0.00008 |
|  | | (0.00007) |
| Property Value PP ($000) | -0.01830*** | -0.01845*** |
|  | (0.00179) | (0.00182) |
| Observations | 1264 | 1264 |
| $R^2$ | 0.96 | 0.96 |
| **Fourth Quartile** | | |
| State Aid Per Pupil | 0.00014 | 0.00012 |
|  | (0.00016) | (0.00015) |
| State Aid PP * Recession | -0.00031*** | |
|  | (0.00005) | |
| State Aid PP * 2009 | | -0.00021*** |
|  | | (0.00004) |
| State Aid PP * 2010 | | -0.00032*** |
|  | | (0.00005) |
| State Aid PP * 2011 | | -0.00036*** |
|  | | (0.00007) |
| State Aid PP * 2012 | | -0.00039*** |
|  | | (0.00008) |
| Property Value PP ($000) | -0.00038 | -0.00036 |
|  | (0.00031) | (0.00030) |
| Observations | 1265 | 1265 |
| $R^2$ | 0.94 | 0.94 |

Notes: *, **, *** denote statistical significance at the 10, 5, and 1% level, respectively. Robust standard errors adjusted for clustering by school district are in parentheses. All regressions include year fixed effects, racial composition, the percent of students eligible for free or reduced price lunch, per-pupil federal aid, and the percent of district funding from state aid. All financial variables are expressed in real terms. The first quartile represents the districts with the lowest per-pupil property values. See specifications (3)-(4) in the text.

**Table 6: Studying Heterogeneity by Region: Did Property Tax Revenue and Local Revenue Responses Vary by Region?**

| | Local Funding Per Pupil FE (1) | Property Tax Revenue Per Pupil FE (2) | Local Funding Per Pupil FE (3) | Property Tax Revenue Per Pupil FE (4) |
|---|---|---|---|---|
| | | Central Region | | |
| State Aid Per Pupil | 0.80*** | 0.50*** | 0.80*** | 0.49*** |
| | (0.11) | (0.13) | (0.11) | (0.13) |
| State Aid PP * Recession | -0.13*** | -0.09*** | | |
| | (0.02) | (0.02) | | |
| State Aid PP * 2009 | | | -0.15*** | -0.10*** |
| | | | (0.02) | (0.03) |
| State Aid PP * 2010 | | | -0.14*** | -0.09*** |
| | | | (0.02) | (0.03) |
| State Aid PP * 2011 | | | -0.12*** | -0.09*** |
| | | | (0.03) | (0.02) |
| State Aid PP * 2012 | | | -0.12*** | -0.07** |
| | | | (0.03) | (0.03) |
| Observations | 376 | 376 | 376 | 376 |
| R$^2$ | 0.99 | 0.98 | 0.99 | 0.98 |
| | | Finger Lakes Region | | |
| State Aid Per Pupil | 0.83*** | 0.55*** | 0.84*** | 0.55*** |
| | (0.12) | (0.12) | (0.11) | (0.12) |
| State Aid PP * Recession | -0.11*** | -0.07*** | | |
| | (0.02) | (0.02) | | |
| State Aid PP * 2009 | | | -0.11*** | -0.07*** |
| | | | (0.02) | (0.02) |
| State Aid PP * 2010 | | | -0.11*** | -0.08*** |
| | | | (0.03) | (0.02) |
| State Aid PP * 2011 | | | -0.13*** | -0.09*** |
| | | | (0.03) | (0.02) |
| State Aid PP * 2012 | | | -0.09*** | -0.06** |
| | | | (0.03) | (0.02) |
| Observations | 544 | 544 | 544 | 544 |
| R$^2$ | 0.99 | 0.99 | 0.99 | 0.99 |
| | | Hudson Valley Region | | |
| State Aid Per Pupil | 1.50*** | 0.87*** | 1.51*** | 0.87*** |
| | (0.32) | (0.13) | (0.29) | (0.13) |
| State Aid PP * Recession | -0.14 | -0.15*** | | |
| | (0.08) | (0.03) | | |
| State Aid PP * 2009 | | | -0.02 | -0.14*** |
| | | | (0.17) | (0.02) |
| State Aid PP * 2010 | | | -0.25*** | -0.18*** |
| | | | (0.05) | (0.03) |
| State Aid PP * 2011 | | | -0.15** | -0.17*** |
| | | | (0.06) | (0.04) |
| State Aid PP * 2012 | | | -0.17* | -0.13*** |
| | | | (0.09) | (0.04) |
| Observations | 780 | 780 | 780 | 780 |
| R$^2$ | 0.97 | 0.99 | 0.97 | 0.99 |

Notes: *, **, *** denote statistical significance at the 10, 5, and 1% level, respectively. Robust standard errors adjusted for clustering by school district are in parentheses. All regressions include year fixed effects, racial composition, the percent of students eligible for free or reduced price lunch, per-pupil federal aid, and the percent of district funding from state aid. All financial variables are expressed in real terms. See specifications (1)-(2) in the text.

**Table 7: Studying Heterogeneity by Region: Did Property Tax Rate Response Vary by Region?**

| | FE | |
|---|---|---|
| | Tax Rate | Tax Rate |
| | (1) | (2) |
| **Central Region** | | |
| State Aid Per Pupil | 0.00063*** | 0.00064*** |
| | (0.00020) | (0.00020) |
| State Aid PP * Recession | -0.00022*** | |
| | (0.00005) | |
| State Aid PP * 2009 | | -0.00018*** |
| | | (0.00006) |
| State Aid PP * 2010 | | -0.00022*** |
| | | (0.00005) |
| State Aid PP * 2011 | | -0.00022*** |
| | | (0.00006) |
| State Aid PP * 2012 | | -0.00027*** |
| | | (0.00006) |
| Property Value PP ($000) | -0.01677*** | -0.01677*** |
| | (0.00333) | (0.00318) |
| Observations | 376 | 376 |
| $R^2$ | 0.96 | 0.96 |
| **Finger Lakes Region** | | |
| State Aid Per Pupil | 0.00079*** | 0.00079*** |
| | (0.00020) | (0.00020) |
| State Aid PP * Recession | -0.00020*** | |
| | (0.00006) | |
| State Aid PP * 2009 | | -0.00019*** |
| | | (0.00005) |
| State Aid PP * 2010 | | -0.00022*** |
| | | (0.00005) |
| State Aid PP * 2011 | | -0.00019*** |
| | | (0.00006) |
| State Aid PP * 2012 | | -0.00020*** |
| | | (0.00007) |
| Property Value PP ($000) | -0.01240*** | -0.01239*** |
| | (0.00223) | (0.00225) |
| Observations | 544 | 544 |
| $R^2$ | 0.97 | 0.97 |
| **Hudson Valley Region** | | |
| State Aid Per Pupil | 0.00032 | 0.00037 |
| | (0.00034) | (0.00033) |
| State Aid PP * Recession | -0.00020*** | |
| | (0.00005) | |
| State Aid PP * 2009 | | -0.00024*** |
| | | (0.00004) |
| State Aid PP * 2010 | | -0.00026*** |
| | | (0.00004) |
| State Aid PP * 2011 | | -0.00017*** |
| | | (0.00006) |
| State Aid PP * 2012 | | -0.00006 |
| | | (0.00007) |
| Property Value PP ($000) | -0.00630*** | -0.00680*** |
| | (0.00091) | (0.00099) |
| Observations | 766 | 766 |
| $R^2$ | 0.94 | 0.95 |

Notes: *, **, *** denote statistical significance at the 10, 5, and 1% level, respectively. Robust standard errors adjusted for clustering by school district are in parentheses. All regressions include year fixed effects, racial composition, the percent of students eligible for free or reduced price lunch, per-pupil federal aid, and the percent of district funding from state aid. All financial variables are expressed in real terms. See specifications (3)-(4) in the text.

**Table 8: Studying Heterogeneity by STAR Revenue Shares: Did the Importance of STAR Revenue Matter in Local and Property Tax Revenue Responses?**

| | Local Funding Per Pupil FE (1) | Property Tax Revenue Per Pupil FE (2) | Local Funding Per Pupil FE (3) | Property Tax Revenue Per Pupil FE (4) |
|---|---|---|---|---|
| | First Quartile | | | |
| State Aid Per Pupil | 0.48*** | 0.28** | 0.52*** | 0.28** |
| | (0.17) | (0.11) | (0.16) | (0.11) |
| State Aid PP * Recession | 0.05 | -0.03 | | |
| | (0.12) | (0.03) | | |
| State Aid PP * 2009 | | | 0.31 | -0.03 |
| | | | (0.36) | (0.02) |
| State Aid PP * 2010 | | | -0.10 | -0.07 |
| | | | (0.07) | (0.05) |
| State Aid PP * 2011 | | | -0.04 | 0.00 |
| | | | (0.04) | (0.03) |
| State Aid PP * 2012 | | | 0.03 | -0.01 |
| | | | (0.06) | (0.04) |
| Observations | 1260 | 1260 | 1260 | 1260 |
| R² | 0.97 | 0.98 | 0.97 | 0.98 |
| | Second Quartile | | | |
| State Aid Per Pupil | 2.04*** | 0.48*** | 2.02*** | 0.48*** |
| | (0.69) | (0.13) | (0.67) | (0.13) |
| State Aid PP * Recession | -0.25*** | -0.20*** | | |
| | (0.09) | (0.04) | | |
| State Aid PP * 2009 | | | -0.34*** | -0.19*** |
| | | | (0.10) | (0.04) |
| State Aid PP * 2010 | | | -0.28*** | -0.22*** |
| | | | (0.11) | (0.06) |
| State Aid PP * 2011 | | | -0.19* | -0.18*** |
| | | | (0.11) | (0.03) |
| State Aid PP * 2012 | | | -0.20* | -0.21*** |
| | | | (0.11) | (0.06) |
| Observations | 1264 | 1264 | 1264 | 1264 |
| R² | 0.94 | 0.98 | 0.95 | 0.98 |
| | Third Quartile | | | |
| State Aid Per Pupil | 1.83*** | 1.50*** | 1.85*** | 1.51*** |
| | (0.15) | (0.16) | (0.15) | (0.17) |
| State Aid PP * Recession | -0.24*** | -0.17*** | | |
| | (0.06) | (0.07) | | |
| State Aid PP * 2009 | | | -0.26*** | -0.20*** |
| | | | (0.04) | (0.05) |
| State Aid PP * 2010 | | | -0.28*** | -0.21*** |
| | | | (0.06) | (0.07) |
| State Aid PP * 2011 | | | -0.19*** | -0.13 |
| | | | (0.07) | (0.08) |
| State Aid PP * 2012 | | | -0.22*** | -0.16* |
| | | | (0.08) | (0.09) |
| Observations | 1262 | 1262 | 1262 | 1262 |
| R² | 0.99 | 0.98 | 0.99 | 0.98 |
| | Fourth Quartile | | | |
| State Aid Per Pupil | 2.00*** | 1.47*** | 2.05*** | 1.52*** |
| | (0.71) | (0.50) | (0.76) | (0.54) |
| State Aid PP * Recession | -0.34*** | -0.31*** | | |
| | (0.06) | (0.06) | | |
| State Aid PP * 2009 | | | -0.25*** | -0.24*** |
| | | | (0.04) | (0.05) |
| State Aid PP * 2010 | | | -0.36*** | -0.32*** |
| | | | (0.10) | (0.09) |
| State Aid PP * 2011 | | | -0.41*** | -0.36*** |
| | | | (0.07) | (0.07) |
| State Aid PP * 2012 | | | -0.39*** | -0.37*** |
| | | | (0.08) | (0.08) |
| Observations | 1271 | 1271 | 1271 | 1271 |
| R² | 0.98 | 0.99 | 0.98 | 0.99 |

Notes: *, **, *** denote statistical significance at the 10, 5, and 1% level, respectively. Robust standard errors adjusted for clustering by school district are in parentheses. All regressions include year fixed effects, racial composition, the percent of students eligible for free or reduced price lunch, per-pupil federal aid, and the percent of district funding from state aid. All financial variables are expressed in real terms. The first quartile represents the districts with the lowest ratio of STAR revenue to state aid. See specifications (1)-(2) in the text.

**Table 9: Studying Heterogeneity by STAR Revenue Shares: Did the Importance of STAR Revenue Matter in Property Tax Rate Responses?**

| | FE | |
|---|---|---|
| | Tax Rate (1) | Tax Rate (2) |
| **First Quartile** | | |
| State Aid Per Pupil | 0.00022** | 0.00022** |
| | (0.00011) | (0.00011) |
| State Aid PP * Recession | -0.00003 | |
| | (0.00006) | |
| State Aid PP * 2009 | | -0.00006 |
| | | (0.00005) |
| State Aid PP * 2010 | | -0.00003 |
| | | (0.00006) |
| State Aid PP * 2011 | | 0.00001 |
| | | (0.00006) |
| State Aid PP * 2012 | | -0.00003 |
| | | (0.00007) |
| Property Value PP ($000) | -0.00467* | -0.00467* |
| | (0.00268) | (0.00267) |
| Observations | 1251 | 1251 |
| $R^2$ | 0.92 | 0.92 |
| **Second Quartile** | | |
| State Aid Per Pupil | 0.00015 | 0.00017 |
| | (0.00019) | (0.00019) |
| State Aid PP * Recession | -0.00017*** | |
| | (0.00006) | |
| State Aid PP * 2009 | | -0.00010* |
| | | (0.00006) |
| State Aid PP * 2010 | | -0.00018*** |
| | | (0.00007) |
| State Aid PP * 2011 | | -0.00020*** |
| | | (0.00007) |
| State Aid PP * 2012 | | -0.00019** |
| | | (0.00008) |
| Property Value PP ($000) | -0.00006 | -0.00005 |
| | (0.00014) | (0.00014) |
| Observations | 1264 | 1264 |
| $R^2$ | 0.94 | 0.94 |
| **Third Quartile** | | |
| State Aid Per Pupil | 0.00046** | 0.00044** |
| | (0.00021) | (0.00021) |
| State Aid PP * Recession | -0.00032*** | |
| | (0.00007) | |
| State Aid PP * 2009 | | -0.00026*** |
| | | (0.00006) |
| State Aid PP * 2010 | | -0.00033*** |
| | | (0.00007) |
| State Aid PP * 2011 | | -0.00033*** |
| | | (0.00009) |
| State Aid PP * 2012 | | -0.00037*** |
| | | (0.00010) |
| Property Value PP ($000) | -0.00174*** | -0.00174*** |
| | (0.00064) | (0.00063) |
| Observations | 1262 | 1262 |
| $R^2$ | 0.95 | 0.95 |
| **Fourth Quartile** | | |
| State Aid Per Pupil | 0.00193*** | 0.00191*** |
| | (0.00038) | (0.00036) |
| State Aid PP * Recession | -0.00020** | |
| | (0.00008) | |
| State Aid PP * 2009 | | -0.00027*** |
| | | (0.00007) |
| State Aid PP * 2010 | | -0.00027*** |
| | | (0.00009) |
| State Aid PP * 2011 | | -0.00014 |
| | | (0.00012) |
| State Aid PP * 2012 | | -0.00010 |
| | | (0.00012) |
| Property Value PP ($000) | -0.00209*** | -0.00213*** |
| | (0.00045) | (0.00046) |
| Observations | 1271 | 1271 |
| $R^2$ | 0.95 | 0.95 |

Notes: *, **, *** denote statistical significance at the 10, 5, and 1% level, respectively. Robust standard errors adjusted for clustering by school district are in parentheses. All regressions include year fixed effects, racial composition, the percent of students eligible for free or reduced price lunch, per-pupil federal aid, and the percent of district funding from state aid. All financial variables are expressed in real terms. The first quartile represents the districts with the lowest ratio of STAR revenue to state aid. See specifications (3)-(4) in the text.

**Table A1: Did Property Tax Revenue and Local Revenue Respond to State Aid Cuts During the Great Recession?**
**(Using Instrumental Variables)**

| | Local Funding Per Pupil IV (1) | Property Tax Revenue Per Pupil IV (2) | Local Funding Per Pupil IV (3) | Property Tax Revenue Per Pupil IV (4) |
|---|---|---|---|---|
| State Aid Per Pupil | 1.19*** | 1.12*** | 1.18*** | 1.12*** |
| | (0.18) | (0.18) | (0.18) | (0.17) |
| State Aid PP * Recession | -0.24*** | -0.20*** | | |
| | (0.03) | (0.03) | | |
| State Aid PP * 2009 | | | -0.19*** | -0.18*** |
| | | | (0.03) | (0.03) |
| State Aid PP * 2010 | | | -0.31*** | -0.22*** |
| | | | (0.04) | (0.04) |
| State Aid PP * 2011 | | | -0.26*** | -0.20*** |
| | | | (0.04) | (0.03) |
| State Aid PP * 2012 | | | -0.22*** | -0.18*** |
| | | | (0.03) | (0.03) |
| Observations | 5052 | 5052 | 5052 | 5052 |

**Table A2: Did Property Tax Rates Respond to State Aid Cuts During the Great Recession?**
**(Using Instrumental Variables)**

| | IV | |
|---|---|---|
| | Tax Rate (1) | Tax Rate (2) |
| State Aid Per Pupil | 0.00042** | 0.00044** |
| | (0.000) | (0.000) |
| State Aid PP * Recession | -0.00028*** | |
| | (0.000) | |
| State Aid PP * 2009 | | -0.00015*** |
| | | (0.000) |
| State Aid PP * 2010 | | -0.00024*** |
| | | (0.000) |
| State Aid PP * 2011 | | -0.00033*** |
| | | (0.000) |
| State Aid PP * 2012 | | -0.00038*** |
| | | (0.000) |
| Property Value PP ($000) | -0.00080** | -0.00080** |
| | (0.000) | (0.000) |
| Observations | 5046 | 5046 |

Notes: *, **, *** denote statistical significance at the 10, 5, and 1% level, respectively. Robust standard errors adjusted for clustering by school district are in parentheses. All regressions include year fixed effects, racial composition, the percent of students eligible for free or reduced price lunch, per-pupil federal aid, and the percent of district funding from state aid. All financial variables are expressed in real terms. See specifications (1)-(4) in the text.

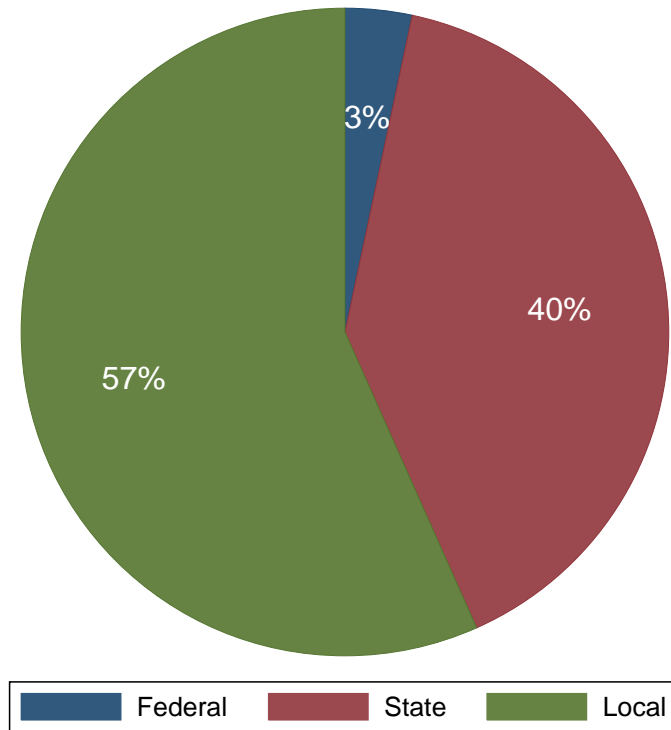**Figure 1: Primary District Funding Sources (2008)**



Pie chart showing:
- Federal: 3%
- State: 40%
- Local: 57%

Legend: Federal | State | Local

**Figure 2: Chronology of State and Local Funding in a representative year
(2011-2012 School Year)**



Timeline:
- 2011
- Early April — State passes budget
- Late May — School districts pass budgets
- September — New property taxes go into effect
- 2012
- June — FY 2012 Ends
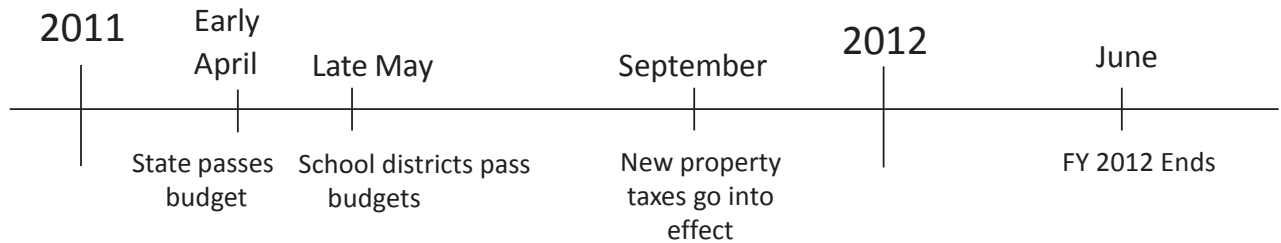
**Figure 3: Regions of New York State**



Legend:
- 1. Western
- 2. Finger Lakes
- 3. Southern Tier
- 4. Central
- 5. North Country
- 6. Mohawk Valley
- 7. Capital District
- 8. Hudson Valley
- 9. NYC
- 10. Long Island
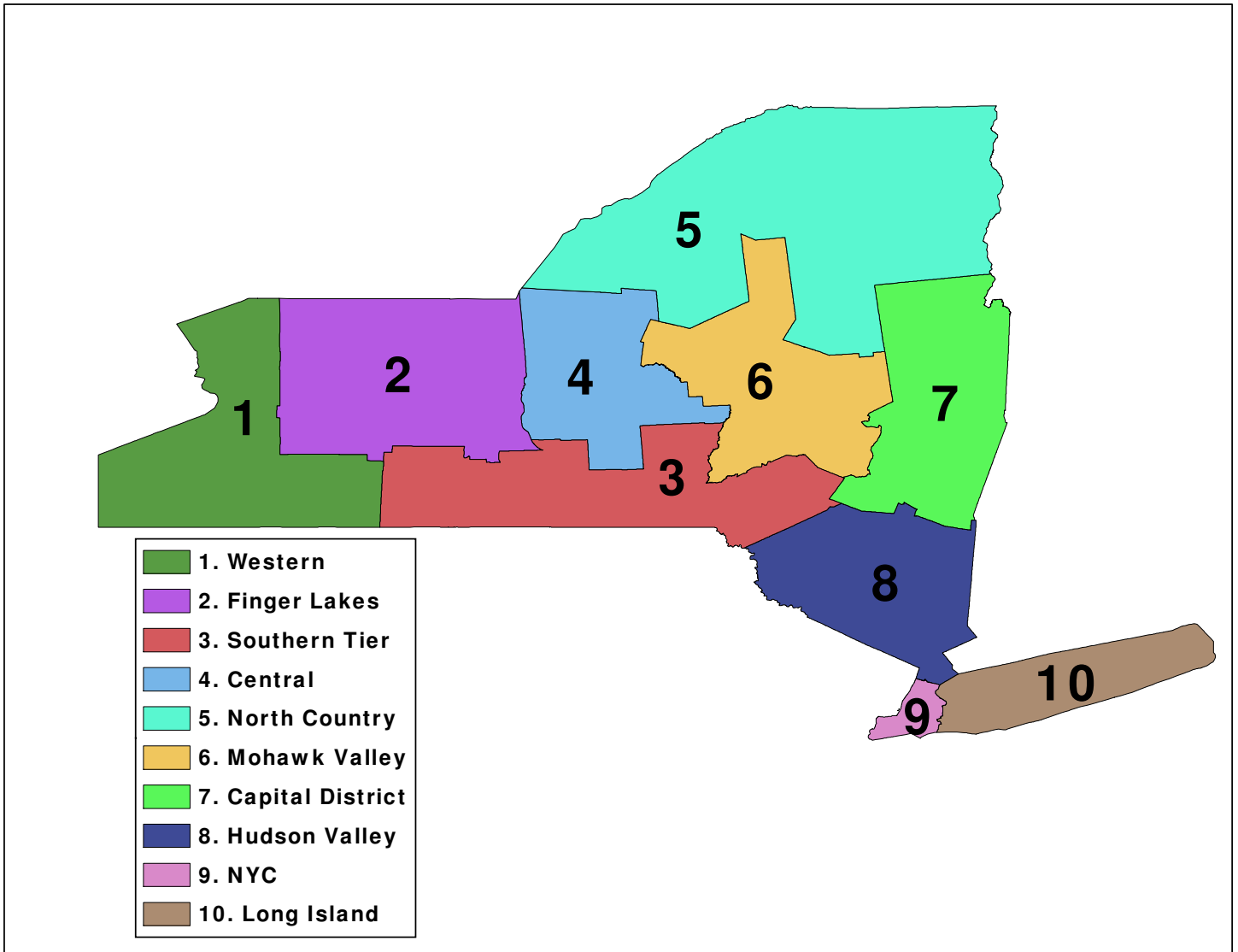
Regions are classified by the New York State Department of Labor.

# Figure 4: Trends in State and Local Funding

## State Aid Per Pupil



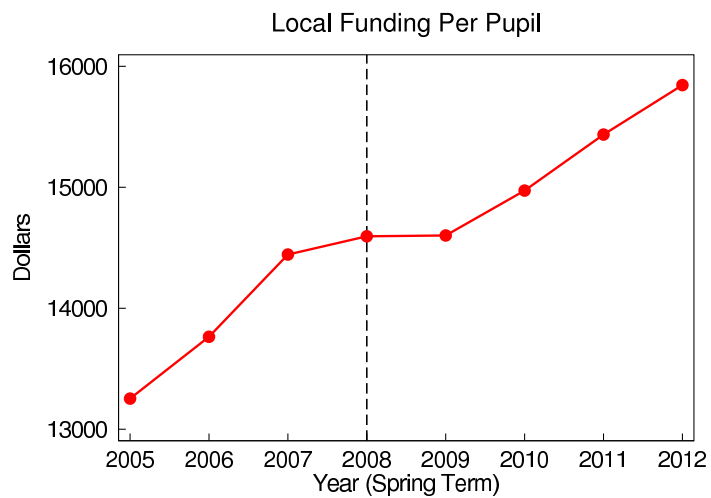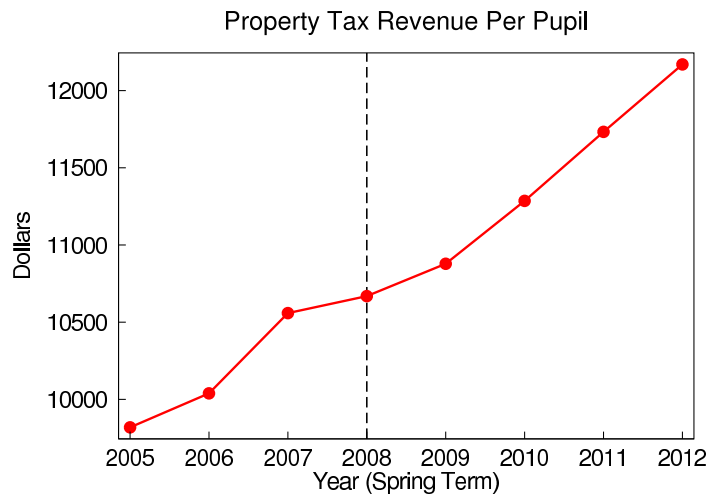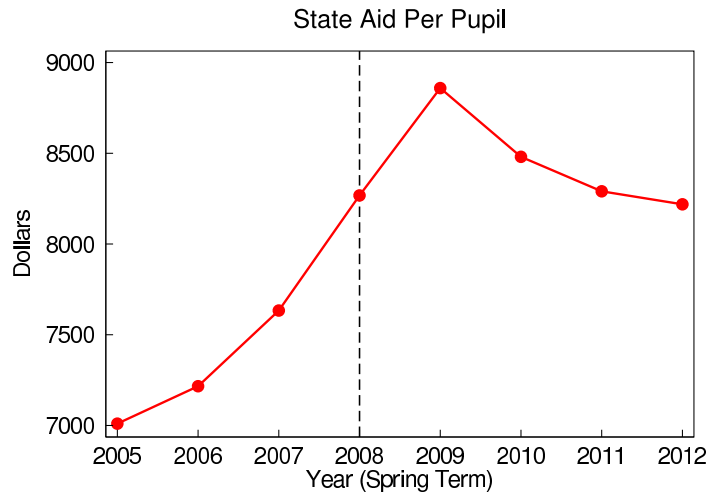## Property Tax Revenue Per Pupil



## Local Funding Per Pupil

Tax Rate (per $000)