

DID PENNSYLVANIA'S STATEWIDE SCHOOL FINANCE REFORM INCREASE EDUCATION SPENDING OR PROVIDE TAX RELIEF?

Matthew P. Steinberg, Rand Quinn,
Daniel Kreisman, and J. Cameron Anglum

We examine how local school districts respond to statewide education finance reform. Specifically, we evaluate the impact of Pennsylvania's Act 61, which provided additional state aid to districts spending below state-determined adequacy targets (spending shortfall districts), on district tax effort in support of education. We find that high-tax shortfall districts reduced their property tax rates significantly more than districts without spending shortfalls and, as a consequence, did not increase educational spending compared with their no-shortfall counterparts. Our results suggest that state equalization aid for high-taxing districts with spending shortfalls was used for property tax relief rather than for supplementing education spending.

Keywords: education finance, state equalization aid, district property tax, education spending

JEL Codes: H52, I22, I28

I. INTRODUCTION

In the United States, local governments are partially responsible for generating the revenue necessary to provide elementary and secondary public education.¹ While a reliance on local revenue — raised primarily through property taxes — allows for local preferences to guide education spending (McGuire, Papke, and Reschovsky, 2015), it

¹ Nationwide, the local contribution to education funding over the last three decades has fluctuated between approximately 45 and 49 percent (Corcoran and Evans, 2015).

Matthew P. Steinberg: Graduate School of Education, University of Pennsylvania, Philadelphia, PA, USA (steima@gse.upenn.edu)

Rand Quinn: Graduate School of Education, University of Pennsylvania, Philadelphia, PA, USA (raq@gse.upenn.edu)

Daniel Kreisman: Department of Economics, Georgia State University, Atlanta, GA, USA (dkreisman@gsu.edu)

J. Cameron Anglum: Graduate School of Education, University of Pennsylvania, Philadelphia, PA, USA (anglumjc@gse.upenn.edu)

has led to resource inequities that disproportionately affect economically disadvantaged school districts (U.S. Department of Education, 2013). Beginning in the late 1960s and continuing to the present day, a wave of legal and legislative efforts have sought to address such disparities through equity- and adequacy-based reform (Ladd, Chalk, and Hansen, 1999; Hanushek and Lindseth, 2009; Superfine, 2010). As a result, over the last half-century, states have played an increasing and evolving role in the financing of local school districts (Corcoran and Evans, 2015). In this article, we examine the heterogeneous response of local school districts to statewide school finance reform.

Among the aims of school finance reform is to decouple property wealth and district spending while maintaining a relationship between local demand for education and local revenue. To accomplish this policy goal, finance reform often includes *variable grant* plans, which come in two forms. “Equalization” grants provide state aid to districts based on property wealth and income, and “local effort” grants provide state aid to low-wealth districts with high tax rates (Card and Payne, 2002; Hoxby, 2001; Jackson, Johnson, and Persico, 2014).² Importantly, while equalization plans do not affect district tax effort directly, they may provide incentives for districts to change their tax effort (Jackson, Johnson, and Persico, 2014).

The degree to which such plans reduce cross-district disparities in resource endowments and educational spending depends on a number of factors, including local response to state aid. Further, the demand for education spending has been shown to be relatively income inelastic (Fisher and Papke, 2000). Specifically, increases in state aid tend not to increase education spending on a dollar-for-dollar basis, with measured elasticities ranging from 0.40 to 0.65. As a result, increased state aid for education may increase spending but not by an equivalent amount. A portion of the increase in state aid will typically result in local property tax relief.

Pennsylvania’s recent school finance reform effort, Act 61, provides a good case study for examining how local school districts respond to school finance reform and to evaluate the effect of increased state aid on local property taxes. While Act 61 was in effect, from the 2008–2009 to the 2010–2011 school years, additional state aid was provided to school districts whose spending fell below state-determined “adequacy” targets. Act 61 entailed both equalization and local effort. State aid was based on the market value of taxable property and personal income (*equalization*) and local school district tax effort (*local effort*). The reform created three categories of local school districts: (1) districts spending at or above the state-determined adequacy target (“no-

² Pennsylvania, Maine, and Missouri are among the states with recent reforms that included equalization and local effort components (Jackson, Johnson, and Persico, 2014). In addition to variable grants, minimum foundation plans ensure a base amount of per-pupil funding across all school districts. The expected contributions from low-wealth districts are supplemented by the state to a set foundation level (Card and Payne, 2002; Hoxby, 2001; Jackson, Johnson, and Persico, 2014). Some state finance reforms incorporate local spending limits in order to reduce spending inequality; some state schemes include a flat grant component — which does not address inequality — to provide per-pupil aid across all districts (Jackson, Johnson, and Persico, 2014).

shortfall” districts); (2) low property tax districts spending below the adequacy target (“low-tax shortfall”); and (3) high property tax districts spending below the adequacy target (“high-tax shortfall”).

We employ a comparative interrupted time series (CITS) design to explore the extent to which low- and high-tax shortfall districts responded differently to the introduction of state school finance reform, using districts without a shortfall as our comparison group. We find that increases in state aid led high-tax shortfall school districts to reduce their property tax rate, compared with no-shortfall districts. The decrease in tax effort among high-tax shortfall districts suggests that additional state support served as a substitute for, rather than as a supplement to, local funding. In contrast, we do not find that low-tax shortfall districts responded differently than no-shortfall districts. We also find that the provision of equalization aid to districts with adequacy shortfalls had no discernible effect on education spending, while also not reducing cross-district achievement disparities (and, at worst, exacerbating achievement differences between high-tax shortfall districts and no-shortfall districts by the third year of the reform).

The introduction of Act 61 occurred amid the onset of the Great Recession, during which local real estate markets were weak and property tax rate increases were politically charged (Leachman and Mai, 2014). We address the threat to the validity of our findings posed by the near simultaneous onset of Act 61 and the Great Recession. Specifically, we show that the key determinants of district tax effort — the market value of taxable property and property tax delinquency — did not differentially change across the three district types with the onset of the Great Recession and the introduction of Act 61.

The article proceeds as follows. We first review the literature on local school district response to changes in state aid. We then characterize district effort in support of local education funding and discuss the resource and policy climate around Pennsylvania's 2008 statewide school finance reform. Next we describe our data and empirical approach for identifying the effect of statewide finance reform on district effort in support of education. We then present and discuss our findings on local district tax effort and educational spending and achievement in the wake of statewide finance reform. We conclude by discussing the implications of Pennsylvania's finance reform efforts.

II. LOCAL SCHOOL DISTRICT RESPONSE TO STATE FINANCE REFORM

In recent years, numerous papers have examined how local school districts respond to state aid (Papke, 2005; Nguyen-Hoang and Hou, 2014; Roy, 2011; Wang, Duncombe, and Yinger, 2011). Much of this research has concentrated on the impact of equalization efforts on district spending and achievement. For example, Card and Payne (2002) studied the effects of court-mandated state equalization reform in the 1980s and found that an additional dollar of state aid resulted in as much as a 66 cent increase in school district spending. The resulting changes in spending inequality were determined to have a “modest” effect on the gap in SAT scores between students with differing parent educational backgrounds (Card and Payne, 2002, p. 80).

Card and Payne emphasized that the level of fiscal substitution they observed is in line with studies identifying a “flypaper effect” of targeted grants on local expenditures. In contrast, other scholars have identified a “crowding-out effect” of state equalization funding, whereby grants are used for tax reductions, with little increase in local spending. New Hampshire reformed its school finance system in 1999 to include the provision of lump sum grants to low-wealth districts and by requiring high-wealth districts to provide payments to the state (i.e., negative grants). Residents of New Hampshire have an uncharacteristically direct role over local budget decisions, allowing for an empirical test of voter preferences over education spending. Estimates of the effect of the reform range from 88 cents to 93 cents per grant dollar being diverted away from education, indicating that when government spending reflects voter preferences, grants are in essence tax relief (Lutz, 2010).

More recently, Jackson, Johnson, and Persico (2014) examined school finance reforms of the last four decades and determined that such efforts — whether induced by litigation or legislation — have substantial effects on spending and achievement (see also Jackson, Johnson, and Persico, 2015).³ Local effort equalization plans increased long-run annual spending growth for poor school districts by \$176 per pupil compared to the pre-reform years and reduced spending gaps between wealthy and poor districts by \$296 per pupil. Equalization plans increased average annual spending for poor districts by \$529 per pupil, reduced spending gaps by \$576 per pupil, and increased both high school graduation rates and overall educational attainment for students from poor families. Taken together, the recent literature suggests that school finance reform that results in increased spending can lead to significant improvements in academic achievement.

A related set of studies examined how school districts respond to recessionary *decreases* in state aid. Evidence from these studies suggests that during periods of economic recession, districts increase their effort in order to stabilize educational revenues in light of declining state support. For instance, Dye and Reschovsky (2008) examined local district responses to state cuts nationwide during the 2001 recession. They estimated that for every dollar decrease in state aid, local property tax revenue increased by 23 cents, evidence of a stabilizing (or even countercyclical) role for local property tax. Unlike earlier recessionary periods, the Great Recession (2007–2009) was marked by substantial federal aid that served to supplement diminished state education funds.⁴ Chakrabarti, Livingston, and Roy (2014) examined local school district response to reductions in state aid in New York during this time. The authors concluded that, relative to the pre-recession period, recession-era decreases in state aid led to increases in local revenue due to increases in the property tax rate. However, this substitution was driven

³ Court-mandated *equity* reforms succeeded in improving equity in district spending, relative to spending in non-reform states; court-mandated *adequacy* reforms succeeded in increasing district spending levels, relative to spending levels in non-reform states, with the poorest decile of districts experiencing the largest increases in spending. While legislative reforms slowed district spending growth, they did lead to reductions in spending inequality, compared with non-reform states (Jackson, Johnson, and Persico, 2015).

⁴ American Recovery and Reinvestment Act. (P.L. 111-5).

by wealthy districts because those districts were best able to take advantage of a state tax relief program that provided matching funds.⁵ In addition, a recent study examined how local governments — apart from school districts — responded to negative financial shocks following the Great Recession (Cromwell and Ihlandfeldt, 2015). The authors found that cities and counties in Florida responded to post-Great Recession reductions in intergovernmental aid by reducing municipal spending without changing property tax rates (Cromwell and Ihlandeldt, 2015).

We add to these lines of scholarship by assessing how local school districts in Pennsylvania differentially responded to increases in state support for education through an equalization and local effort plan. Low wealth districts are more likely to face credit constraints that limit desired levels of educational spending. For such districts, additional state aid should lead to increases in educational spending.⁶ As evidence, Lutz (2010) finds that lower income communities in New Hampshire offset intergovernmental grants to a lesser extent than wealthier communities. However, in the absence of both credit constraints and changes to residents' preferences for educational spending in the post-reform period, additional state aid should lead to property tax relief.

In Pennsylvania, shortfall districts are poorer, based on property values and personal income, than no-shortfall districts; among shortfall districts, high-tax districts are poorer, based on property values, than low-tax districts (Table 2). Therefore, we might expect high-tax shortfall districts, those which appear to be the most credit constrained, *ex ante*, to apply at least some portion of additional state aid to increases in educational spending (the flypaper effect). On the other hand, these same high-tax shortfall districts taxed their residents at rates nearly 50 percent higher than low-tax shortfall districts (Table 2); as a result, we might expect high-tax shortfall districts to apply at least some portion of additional state aid to property tax relief (the crowding-out effect). Taken together, the net effect on changes in educational spending (for high- and low-tax districts compared to no-shortfall districts) will depend on the relative magnitudes of the crowding-out (due to property tax relief) and flypaper effects.

In sum, if following the introduction of statewide school finance reform low-wealth districts maintain their pre-reform tax effort, they may realize substantial improvements in educational spending relative to their more advantaged counterparts.⁷ Increases in spending may in turn lead to improvements in academic outcomes. However, extant scholarship suggests that districts will increase spending but not by the full grant amount. Rather, high-taxing districts may decide to provide tax relief to their residents,

⁵ The tax relief program was structured such that wealthy districts could increase spending at a lower cost to themselves than non-wealthy districts (Chakrabarti, Livingston, and Roy, 2014).

⁶ We assume that the pre-reform period was characterized by Tiebout sorting across Pennsylvania school districts such that district spending was determined by the median voter. Under this model, households would have sorted themselves across school districts according to their demand for education spending.

⁷ This result would be consistent with evidence from Florida, which finds that decreases in state aid led to decreases in municipal spending absent any changes to property tax rates (Cromwell and Ihlandfeldt, 2015).

potentially limiting the extent to which state finance reform can reduce spending and achievement inequities.

III. DISTRICT TAX EFFORT IN SUPPORT OF EDUCATION IN PENNSYLVANIA

Pennsylvania school boards annually set a real estate tax (RET) rate in order to generate a desired level of local property tax revenue (PTR) that is payable to district i in school year t .⁸ The RET rate is then levied on the assessed value (AV) of taxable property to generate a desired level of local PTR.⁹ Given a desired level of PTR and the AV of taxable property, district i 's RET rate in school year t can then be calculated as

$$(1) \quad RET_{it} = \frac{PTR_{it}^{payable}}{AV_{it}}.$$

The amount of local PTR that a district collects often differs from the amount of PTR that is payable due to tax delinquencies. To standardize district tax effort, the Pennsylvania Department of Education calculates an equalized millage (EM) rate.¹⁰ The EM rate is a function of PTR collected and the market value (MV) of taxable property,¹¹

$$(2) \quad EM_{it} = \frac{PTR_{it}^{collected}}{MV_{it}}.$$

Each local school district in Pennsylvania has a preference for educational investment, and those preferences shape the amount of local resources districts aim to raise in support of education through the RET rate. At the same time, the amount of resources districts can raise in support of education is constrained by the market value of property and, importantly, the assessed value of that property that is taxable and can be used to raise local resources. Formally, the RET rate set by district i in school year t depends on the demand for educational spending (reflected by the district's desired level of PTR) and available resources, based on the AV of taxable property upon which districts may generate PTR, or

$$(3) \quad RET_{it} = f(AV_{it}, PTR_{it}).$$

⁸ Pennsylvania grants local school districts boards power of local taxation. Pennsylvania Public School Act of Mar. 10, 1949, P.L. 30, No. 14, §507.

⁹ With the exception of the School District of Philadelphia, each Pennsylvania school district can increase its property tax millage rate up to a state-imposed limit based on the statewide average weekly wage (SAWW) measure and the employment cost index (ECI), a federal measure of compensation, in order to balance its budget. During the reform period, the base index was 4.4 percent, 4.1 percent, and 2.9 percent for each successive year. School districts with an aid ratio greater the 0.40 (i.e., nonwealthy districts) received an enhancement factor to the base index. Districts with expenses exceeding revenue could raise rates beyond the index by receiving a waiver from the state or by seeking voter approval.

¹⁰ The PDE and the Pennsylvania Tax Equalization Division (TED) report data on district i 's RET, AV, EM, and MV for school year t .

¹¹ See Figure 5 for the statewide trends in market and assessed value of taxable property.

The RET rate set by district school boards reflects not only local effort in support of education but also local resources available to support education, as determined by the assessed value (AV) of taxable property. Further, since the timing of property assessments is endogenous and therefore limits the comparability of changes in tax effort across districts, the EM rate provides a more comparable measure of district tax effort for supporting local spending on educational investments than does the RET rate. Table A1 in the online Appendix¹² provides a stylized example of this; the accompanying Figure A1 shows that the empirical distribution of the AV/MV ratio varies across Pennsylvania districts (by Act 61-determined shortfall status) both within and across years. Further, since local PTR depends on the RET rate and the AV of taxable property, we focus on changes to the EM rate rather than to local PTR to gain insight into whether statewide finance reform affected local district support of education. See Table A2 in the online Appendix for a summary of district tax rates, property values, and property taxes.

IV. SCHOOL FINANCE REFORM IN PENNSYLVANIA¹³

In 2006, the Pennsylvania General Assembly directed the State Board of Education to commission a study to determine the resources required to provide a quality primary and secondary education for each student (Augenblick, Palaich and Associates, Inc., 2007) (the “costing out” study).¹⁴ The study considered both equity — defined for the purpose of the study as “whether public resources being committed to education are distributed in such a way that all children, regardless of race, gender, ethnicity, disability, socioeconomic status and geography, have an equal opportunity to succeed in school” — and adequacy — “whether sufficient resources, both State and local, are being committed to meet established performance standards and assure academic success for all.”¹⁵ The resulting study proposed a formula to equitably distribute resources and determined that an additional \$4.38 billion in spending was necessary to meet student achievement targets for the 2005–2006 school year (Augenblick, Palaich and Associates, Inc., 2007).¹⁶

In February 2008, during his annual budget address, the Governor proposed reforming Pennsylvania's school finance system (see online Appendix Figure A2 for a timeline of events). In July 2008, the Pennsylvania school code was amended to include language mandating that education funding to districts be based largely on the formula offered by the costing out study (the funding scheme is informally referred to as “Act 61”). The stated goal of Act 61 was to close 50 percent of the total statewide adequacy

¹² See the online Appendix at http://www.gse.upenn.edu/pdf/Steinberg-et-al_NTJ_2016.pdf.

¹³ For a more detailed discussion of school finance reform in Pennsylvania, see Steinberg and Quinn (2015).

¹⁴ Act of July 11, 2006, P.L. 1092, No. 114, §2259.3

¹⁵ Act of July 11, 2006, P.L. 1092, No. 114, §2259.3(b)

¹⁶ In line with similar efforts across the nation, the study proposed a base cost (\$8,003 per student) plus cost weights and additional cost factors, resulting in a per-student estimate of \$11,926, compared with actual per-student spending of \$9,512. To calculate the adequacy target, enrollment was from the current year while demographic data was from two years prior.

gap over a six-year period in order to reduce cross-district spending and achievement inequities.¹⁷

To support this mandate, districts with an adequacy shortfall received what Pennsylvania referred to as a *state share phase-in allocation*. The mechanism to determine the state share phase-in was as follows (see online Appendix Figure A3 for a schematic). Starting with the 2008–2009 school year, an adequacy target was calculated for each school district. The adequacy target began with a base cost per student and took into account district characteristics, including number of students in poverty, enrollment over time, number of English-language learners, and location. For districts with an adequacy shortfall, a state funding target — which amounted to a percentage of the adequacy target — was determined.¹⁸ The poorest districts and highest taxing districts had state funding targets closest to their calculated adequacy shortfalls.¹⁹ Each school district with an adequacy shortfall received a state share phase-in allocation equal to a percentage of its state funding target based on its tax effort. In his 2008 budget address to the general assembly, Governor Rendell pledged to close half of the identified adequacy gap over a six-year period (Rendell, 2008). The pledge came with the expectation — but, importantly, no formal mandate — that local districts would close the remaining half of the spending gaps.²⁰ Three years after the Governor made his pledge, under a new administration, the funding formula and state share phase-in were removed from the school code for the 2011–2012 school year.²¹

A. State Share Phase-in Allocation

For school districts with identified adequacy shortfalls, the state share phase-in allocation was calculated based on each school district's 2006–2007 equalized millage rate. In the first year of the reform (2008–2009), each “high tax” district, defined as those with a millage rate equal to or above 24.7 (defined as the rate at the 80th percentile) received

¹⁷ “In furtherance of the General Assembly’s long-standing commitment to providing adequate funding that will ensure equitable State and local investments in public education and in order to enable students to attain applicable Federal and State academic standards, it is the goal of this Commonwealth to review and meet State funding targets by fiscal year 2013–2014” (Act of July 9, 2008, P.L. 846, No. 61, §2502.48). As enacted, the reform did not include a statement of rationale or intent to provide property tax relief.

¹⁸ Actual spending from two years prior was used to calculate the adequacy shortfall. District wealth and tax effort from two years prior were used to calculate the state funding target and state share phase-in allocation.

¹⁹ The state determines district wealth through its market value/personal income aid ratio, a formula that relies on the sales value of taxable real estate and personal income for a district. The formula produces a value from 0.15 (the wealthiest districts) to over 0.80 (the poorest districts). Public School Code of 1949, Act of Mar. 10, 1949, P.L. 30, No. 14, §2501(14) & §2501(14.1).

²⁰ Authors’ communication with Ron Cowell, President, The Education Policy and Leadership Center (October 31, 2013).

²¹ Act of June 30, 2011, P.L. 112, No. 24. There is no indication that local district response to additional state aid under Act 61 influenced the new administration’s decision to discontinue the state’s finance reform effort.

a state share phase-in allocation equal to 16.75 percent of its state funding target; each “low tax” district with a millage rate below 24.7 received an allocation equal to 10 percent of its state funding target. In the second year of the reform (2009–2010), each district with a millage rate equal to or above 24.7 received a state share phase-in allocation equal to 27.82 percent of its state funding target; each district with a millage rate below 24.7 received an allocation equal to 21.40 of its state funding target. For the final year of the reform (2010–2011), each high-tax and low-tax shortfall district received a state share phase-in allocation equal to 32.06 of its state funding target.

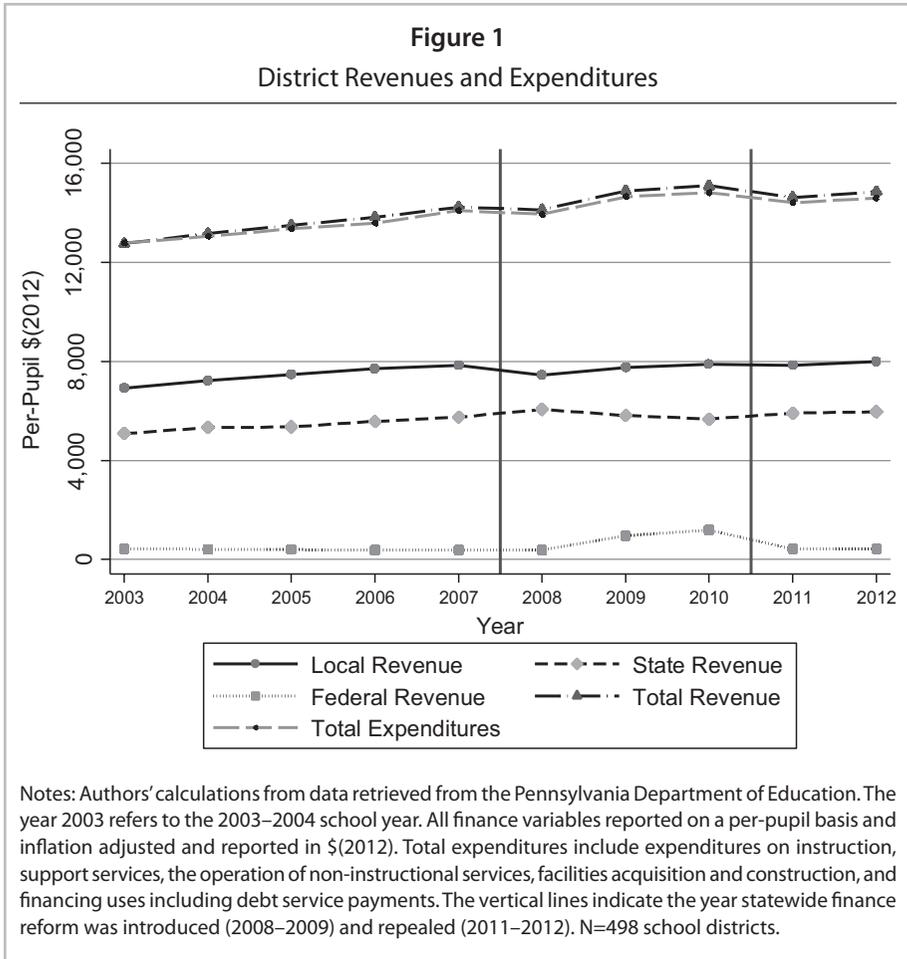
The state share phase-in allocation was a comparatively minor component of Pennsylvania's Basic Education Funding (BEF) appropriation.²² In the first year of the reform period, basic education made up approximately 60 percent of state aid to districts; in the final year of the reform period, basic education made up approximately 70 percent of state aid to districts. The state share phase-in allocation for high-tax districts with adequacy shortfalls equaled 3.8 percent, 7.4 percent, and 8.5 percent of total state aid during each consecutive year of the reform period from the 2008–2009 school year to the 2010–2011 school year; these allocations amounted to, on average, \$236, \$425, and \$479 per pupil for each consecutive year of the reform period, relative to total expenditures of \$14,842, \$15,483, and \$15,900 (Table A3). The state share phase-in allocation for low-tax districts with adequacy shortfalls equaled 1.7 percent, 4.5 percent, and 7.1 percent of total state aid during each consecutive year of the reform period, from the 2008–2009 school year to the 2010–2011 school year; this amounted to, on average, \$107, \$270, and \$414 per pupil for each consecutive year of the reform period, relative to total expenditures of \$13,276, \$14,057, and \$14,162 (Table A3). In short, the state phase-in allocation provided to shortfall districts represented a modest share of total state aid.

B. Revenue and Expenditure Trends

Figure 1 provides visual evidence of per pupil revenue and expenditure trends (see also Table A3). From the 2007–2008 to 2008–2009 school year, inflation-adjusted per-pupil state revenue across all districts increased by 5.6 percent from \$5,746 to \$6,065. Total revenue during this period essentially remained steady, from \$14,235 to \$14,121. For the 2009–2010 and 2010–2011 school years, the state's education appropriation was paid from a combination of state and federal stimulus funds. From the 2007–2008 to 2008–2009 school year, total expenditures across all districts remained relatively steady, from \$14,093 to \$13,945.

Figure 2 provides visual evidence of state revenue trends across school districts by shortfall status. With the implementation of Act 61 in 2008, state revenue increased across all district categories and the gap between high- and low-tax districts with

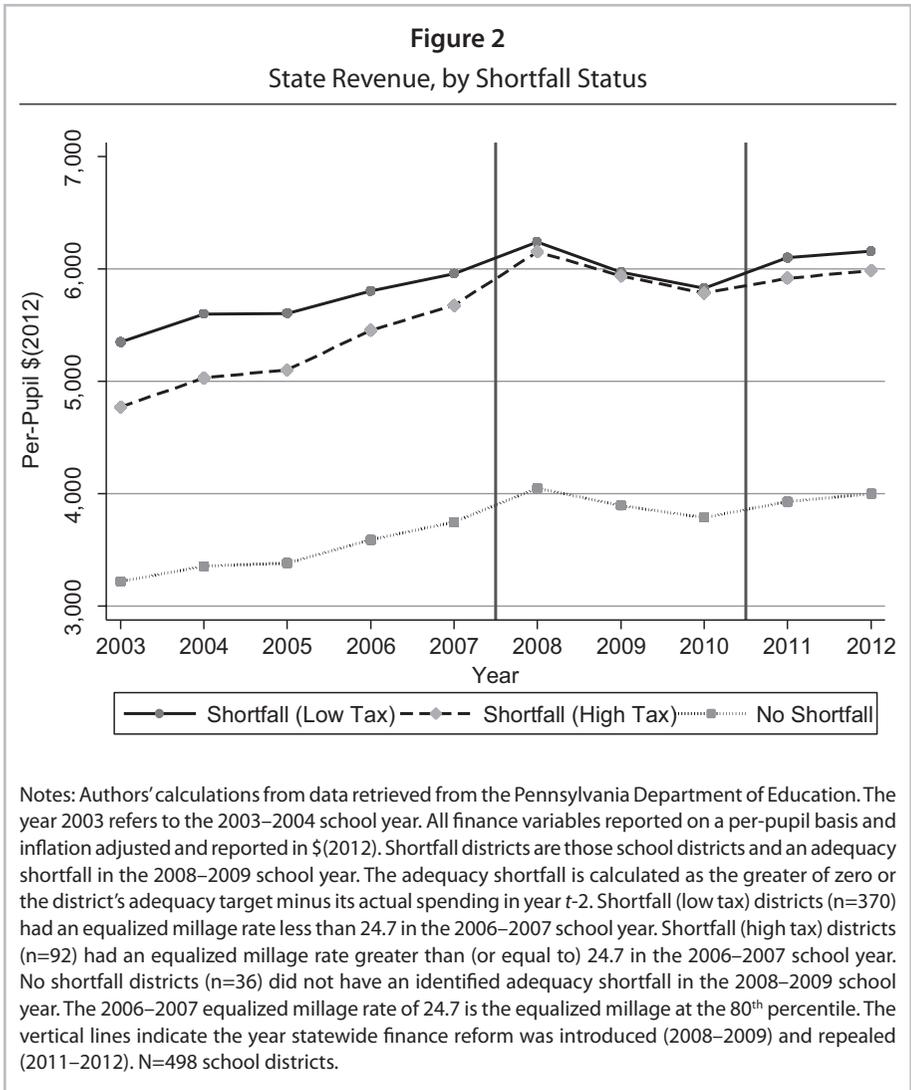
²² Basic education totaled just over \$5.2 billion in the 2008–2009 school year, \$5.5 billion in 2009–2010, and \$5.8 billion in 2010–2011.



adequacy shortfalls narrowed.²³ From the 2007–2008 to the 2008–2009 school year, per-pupil state revenue for high-tax shortfall districts increased by 8.4 percent from \$5,677 to \$6,152, while state revenue for low-tax shortfall districts increased by 4.7 percent from \$5,958 to \$6,240. State revenue increased by 8.1 percent for districts without an adequacy shortfall from \$3,746 to \$4,048.²⁴

²³ Pennsylvania's Basic Education Funding (BEF) annual appropriation included a hold harmless component that provided every school district additional funding, if necessary, so that total allocations equaled a minimum increase over prior year allocations. The minimum increase was 2.0 percent for the 2007–2008, 2009–2010, 2010–2011, and 2011–2012 school years; the minimum increase was 3.0 percent for the 2008–2009 school year.

²⁴ Total state revenue includes funds allocated to school districts through the BEF, as well as other non-BEF state aid provided to school districts. Pennsylvania's Act 61 and the state phase-in operated through the BEF portion of total state aid.



V. DATA AND SAMPLE

We construct a district-level panel dataset for the 2003–2004 through 2012–2013 school years. Recall that Act 61 was in effect from the 2008–2009 through 2010–2011 school years. This panel includes district-level revenue, expenditure, and achievement data from the Pennsylvania Department of Education (PDE).²⁵ District revenue data

²⁵ District-level revenue, expenditure, and achievement data were obtained from Pennsylvania Department of Education website (<http://www.education.pa.gov/Pages/default.aspx#.VxaTGPrJhE>).

include state, local, and federal contributions to district revenue and are inflation adjusted and reported in real \$(2012). For district expenditure data (also inflation-adjusted and reported in real \$(2012), we distinguish between total expenditures — which are inclusive of spending on instruction, support services, non-instructional services, facilities acquisition, and other financing uses (such as debt service) — and categorical spending on instruction-related activities, support services, and non-instructional services.²⁶ We also gather data on the total amount of personal income for district residents.²⁷ Additionally, we construct a district-level achievement measure equal to the weighted average share of a district's students who are proficient or advanced on the math and reading portions of the Pennsylvania System of School Assessment (PSSA).

We supplement financial and achievement data with district-level demographic data from the Common Core of Data (CCD) collected by the U.S. Department of Education's National Center for Education Statistics.²⁸ District demographic characteristics include district enrollment (all prekindergarten, kindergarten, and grades 1–12 students enrolled in traditional public schools),²⁹ the proportion of students receiving free or reduced-price lunch (FRPL), the proportion of students identified as English language learners (ELL), the proportion of students receiving individualized education plans (IEP), the proportion of students who are African American or Hispanic (i.e., minority students), and geographic variables indicating the district's location relative to population centers (urban, suburban, rural, or town). We also include detailed information from the PDE describing the components of Pennsylvania's 2008 statewide finance reform, including data on the following district-level measures: (1) adequacy shortfall; (2) state funding target; and (3) state phase-in.³⁰

We are principally concerned with how the introduction of statewide finance reform during the 2008–2009 school year affected local district tax effort in support of education spending. As previously discussed, a district's equalized millage rate is the most comparable measure of that district's local tax effort in support of education. The equal-

²⁶ Instruction-related activities include expenditures for activities dealing directly with the interaction between teachers and students and costs related to the activities of aides or classroom assistants who assist in the instructional process. Support services include expenditures for services that provide administrative, technical (such as guidance and health), and logistical support to facilitate and enhance instruction. Non-instructional services include expenditures on food services, student activities, community services, and scholarships and awards.

²⁷ Personal income data were obtained from Pennsylvania Department of Education website (<http://www.education.pa.gov/Pages/default.aspx#.VxaTGPrJhE>).

²⁸ National Center for Education Statistics, Common Core of Data, <https://nces.ed.gov/ccd/ccddata.asp>.

²⁹ Since total enrollment from CCD was unavailable for all school districts in all years, we use average daily membership (ADM) from PDE. ADM is calculated by dividing the aggregate days membership for all children on active rolls by the number of days the school district is in session. All per-pupil measures use ADM.

³⁰ Data describing the elements of Pennsylvania's Basic Education Funding were obtained from the Commonwealth of Pennsylvania's Enterprise Portal, <http://www.portal.state.pa.us/portal/server.pt?open=514&objID=509059&mode=2>.

ized millage rate is the ratio of a school district's total taxes collected and remitted to its total property value.³¹

We include 498 (of the 500) Pennsylvania school districts in our analytic sample (see online Appendix Figure A4 for a map of Pennsylvania school districts by shortfall status).³² Table 1 summarizes district demographic and achievement characteristics. On average, districts with an identified adequacy shortfall served more disadvantaged student populations. Among shortfall districts with high tax rates, 36 percent of students, on average, received FRPL; these districts also served a more urban and minority population of students compared with no-shortfall districts. High-tax shortfall districts were also, on average, lower achieving than their district counterparts that spent above adequate levels.

Table 2 summarizes the financial characteristics of Pennsylvania districts, by tax effort and shortfall status. As might be expected, districts with identified adequacy shortfalls spent \$5,225 less, on average, in the year before statewide finance reform (2007–2008) than their no-shortfall counterparts. Moreover, adequacy shortfall districts relied more heavily on state funding — 38 percent among high-tax districts and 44 percent among low-tax districts — than districts without an adequacy shortfall (where 20 percent of district resources were funded by state aid). Districts without shortfalls relied more heavily on local revenue. Indeed, 76 percent of total revenue for districts without an adequacy shortfall came from local resources, while local funding was a source of 57 percent of revenue for high-tax shortfall districts and 52 percent of revenue for low-tax shortfall districts. Not only does the share of total funding derived from local revenues differ across districts, but so does local property wealth. Districts without adequacy shortfalls have significantly greater local property tax wealth from which to generate local revenue than do districts with adequacy shortfalls. Specifically, the market value of property for no-shortfall districts in the pre-reform year (2007–2008) was, on average, \$718,272 per pupil compared to \$331,889 per pupil, on average, among shortfall districts.

VI. EMPIRICAL APPROACH

The focus of the empirical work is on whether (and the extent to which) local district tax effort, captured by a district's equalized millage rate, responded to statewide finance reform. We also explore the consequences of statewide finance reform on district expenditures as well as student achievement. As discussed earlier, Pennsylvania's statewide finance reform created distinct district types. Specifically, districts without adequacy shortfalls (irrespective of their tax effort) received no additional state aid

³¹ Pennsylvania Department of Education, http://www.portal.state.pa.us/portal/server.pt/community/summaries_of_afr_data/7673/glossary_for_revenues/509037.

³² The Center Area School District and the Monaca School District merged to form the Central Valley School District in the 2009–2010 school year; all three districts are excluded from analysis. The Bryn Athyn School District does not operate any public schools and is also excluded from analysis.

Table 1
District Demographic Characteristics

District Characteristic	All Districts	All Shortfall	All No Shortfall	Difference (Shortfall vs. No Shortfall)	High Tax Shortfall	Low Tax Shortfall	Difference (High vs. Low Tax)
Enrollment	3,446.0 (8,118.1)	3,374.9 (8,331.3)	4,358.2 (4,545.7)	938.3 (1,405.5)	3,781.1 (3,244.0)	3,273.9 (9,169.0)	507.2 (971.4)
FRPL	0.30 (0.15)	0.31 (0.15)	0.17 (0.17)	0.14*** (0.03)	0.36 (0.18)	0.30 (0.13)	0.06*** (0.02)
ELL	0.01 (0.02)	0.01 (0.02)	0.01 (0.01)	0.00 (0.00)	0.02 (0.03)	0.01 (0.02)	0.01*** (0.00)
IEP	0.17 (0.03)	0.16 (0.03)	0.17 (0.03)	0.00 (0.01)	0.18 (0.03)	0.16 (0.03)	0.01*** (0.00)
Minority	0.10 (0.15)	0.09 (0.15)	0.12 (0.18)	0.02 (0.03)	0.23 (0.24)	0.06 (0.09)	0.17*** (0.02)
Math achievement	74.3 (9.5)	73.7 (9.1)	81.1 (10.8)	7.4*** (1.6)	68.6 (12.8)	75.0 (7.4)	6.4*** (1.0)
Reading achievement	72.5 (9.9)	71.8 (9.5)	80.9 (11.6)	9.1*** (1.7)	66.5 (13.6)	73.2 (7.6)	6.7*** (1.1)

Table 1 (Continued) District Demographic Characteristics

District Characteristic	All Districts	All Shortfall	All No Shortfall	Difference (Shortfall vs. No Shortfall)		High Tax Shortfall	Low Tax Shortfall	Difference (High vs. Low Tax)
Urban	0.03	0.03	0.03	0.00	0.08	0.02	0.06***	
Suburban	0.42	0.39	0.78	0.39***	0.66	0.32	0.34***	
Rural	0.35	0.37	0.14	0.23***	0.15	0.42	0.27***	
Town	0.20	0.21	0.06	0.15**	0.11	0.24	0.13***	
Districts	498	462	36		92	370		

Notes: Mean (standard deviation) of district characteristics are reported for the 2007–2008 school year; for geographic characteristic (urban, suburban, rural, and town), proportion of sample is indicated. Shortfall districts are those with an identified adequacy shortfall in the 2008–2009 school year. High-tax districts had 2006–2007 equalized mill rate greater than or equal to 24.7 mills; low-tax districts had 2006–2007 equalized mill rate less than 24.7 mills. Enrollment includes all pre-kindergarten, kindergarten, and grades 1–12 students enrolled in public (non-charter) schools. FRPL is the proportion of a district's students receiving free or reduced-price lunch. ELL is the proportion of a district's students who are English language learners; IEP is the proportion of a district's students who receive an individualized education plan. Minority is the proportion of a district's students who are Black or Hispanic. Math (reading) achievement is the proportion of a district's students proficient or advanced on the math (reading) portion of the Pennsylvania System of School Assessment (PSSA); achievement is for students in grades 3–8 and 11. Asterisks denote significance at the 1% (***), 5% (**), and 10% (*) levels.

Table 2
Revenue, Expenditure, and District Resource Characteristics

District Characteristic	All		All		All		Difference (Shortfall vs. No Shortfall)		Difference (High vs. Low Tax)	
	Districts	Shortfall	No Shortfall	Shortfall	No Shortfall	Shortfall	Shortfall	High Tax Shortfall	Low Tax Shortfall	High vs. Low Tax
Local revenue	7,840.9 (3,525.0)	7,308.5 (2,899.3)	14,674.5 (3,734.7)	7,336.1*** (513.2)	8,576.9 (2,850.9)	6,993.1 (2,827.8)	1,583.8*** (330.0)			
State revenue	5,746.5 (2,367.5)	5,902.4 (2,304.6)	3,746.2 (2,280.3)	2,156.2*** (398.5)	5,677.3 (2,428.7)	5,958.3 (2,272.7)	281.0 (268.5)			
Federal revenue	379.0 (312.0)	382.6 (302.1)	333.0 (421.0)	49.6 (54.0)	497.2 (428.1)	354.1 (254.5)	143.1*** (34.6)			
Other revenue	268.2 (1,328.0)	253.8 (1,232.8)	452.7 (2,233.7)	198.9 (229.9)	272.4 (1,305.2)	249.1 (1,215.9)	23.3 (143.8)			
Total revenue	14,234.6 (2653.7)	13,847.2 (2,151.4)	19,206.0 (3,409.5)	5,359.2*** (391.6)	15,023.9 (2,320.4)	13,554.6 (2,005.9)	1,469.3*** (241.4)			
Total expenditures	14,093.8 (2,659.4)	13,716.1 (2,181.9)	18,940.8 (3,417.1)	5,224.7*** (396.4)	14,839.3 (2,259.9)	13,436.8 (2,072.6)	1,402.5*** (245.9)			
Market value of property	359,820.5 (191,325.6)	331,889.2 (138,064.7)	718,272.1 (355,344.1)	386,382.9*** (28,236.0)	283,321.3 (104,607.0)	343,965.6 (142,763.7)	60,644.3*** (15,851.8)			

Table 2 (Continued) Revenue, Expenditure, and District Resource Characteristics

District Characteristic	All Districts	All		Difference (Shortfall vs. No Shortfall)		High Tax Shortfall	Low Tax Shortfall	Difference (High vs. Low Tax)
		Shortfall	No Shortfall	Shortfall	No Shortfall			
Personal income	166,856.7 (91,782.7)	152,919.1 (56,323.7)	345,721.8 (205,830.7)	192,802.6*** (13,334.1)	148,939.0 (53,184.5)	153,908.8 (57,103.5)	4,969.8 (6,564.8)	
Equalized mill rate	20.9 (5.3)	20.8 (5.2)	22.0 (6.8)	1.2 (0.9)	28.7 (3.5)	18.8 (3.3)	9.9*** (0.4)	
Districts	498	462	36		92	370		

Notes: Mean (standard deviation) of district characteristics are reported for the 2007-2008 school year. All finance variables reported on a per-pupil basis and inflation adjusted and reported in \$(2012). Total revenue is defined as the sum of local revenue, state revenue, federal revenue, and other revenue. State revenue is defined as revenue originating from Commonwealth of Pennsylvania appropriations and directly disbursed to school district. Local revenue is defined as the sum of local taxes and local other revenue. Federal revenue is defined as revenue originating from federal sources and made available to the school district through direct grants, state channels, or other agencies conducting programs through school districts. Other revenue includes revenue from the sale of bonds, proceeds from extended-term financing, interfund transfers, receipts from other local education agencies, sale of or compensation for loss of fixed assets, and refunds of prior years' expenditures. Expenditures include expenditures on instruction, support services, the operation of non-instructional services, facilities acquisition and construction, and financing uses including debt service payments. Market value of property is the sales value of taxable real estate as certified by the Pennsylvania State Tax Equalization Board. The equalized millage rate is the standardized millage calculated by dividing a school district's total taxes collected and remitted by the market value of taxable property (as certified by the Pennsylvania State Tax Equalization Board). Asterisks denote significance at the 1% (***), 5% (**), and 10% (*) levels.

through the state share phase-in, while those with shortfalls received equalization aid as a function of their pre-reform tax effort. To explore the extent to which low-tax and high-tax districts with adequacy shortfalls responded differently to the introduction of state reform, we employ a comparative interrupted time series (CITS) design, using districts that did not receive state share phase-in (i.e., those districts without adequacy shortfalls) as our comparison group. Following Dee and Jacob (2011) and Steinberg and Sartain (2015), we specify the model in the context of the CITS design for the 2003–2004 through 2010–2011 period as

$$\begin{aligned}
 (4) \quad EM_{it} = & \beta_0 + \beta_1 Year_t + \beta_2 Reform_t + \beta_3 (Years_Since_Reform_t) \\
 & + \beta_4 (HighTax_i \times Year_t) + \beta_5 (HighTax_i \times Reform_t) \\
 & + \beta_6 (HighTax_i \times Years_Since_Reform_t) \\
 & + \beta_7 (LowTax_i \times Year_t) + \beta_8 (LowTax_i \times Reform_t) \\
 & + \beta_9 (LowTax_i \times Years_Since_Reform_t) + \mathbf{X}_{it} \Gamma + \theta_i + \varepsilon_{it},
 \end{aligned}$$

where EM_{it} is the equalized mill rate, a measure of district i 's local tax effort toward supporting education in year t . The variable $Year_t$ is a trend variable defined as $Year_t - 2002$ and starts at a value of one in the first year of the sample (2003–2004 school year). $Reform_t$ is a dummy variable indicating the post-reform period, such that observations in the pre-reform period (2003–2004 through 2007–2008) take on a value of zero, and observations during the state's finance reform period (2008–2009 through 2010–2011) take on a value of one. The variable $Years_Since_Reform_t$ captures the number of years since the state first introduced finance reform and equals one in the 2008–2009 school year, two in the 2009–2010 school year, and three in the 2010–2011 school year. The variable $HighTax_i$ is a time-invariant indicator for whether a district had an adequacy shortfall *and* was a high-tax district (i.e., 2006–2007 equalized millage rate greater than or equal to 24.7 mills). The variable $LowTax_i$ is a time-invariant indicator for whether a district had an adequacy shortfall *and* was a low-tax district (i.e., 2006–2007 equalized millage rate less than 24.7 mills). The vector \mathbf{X}_{it} includes time-varying district characteristics, including student enrollment, the share of economically disadvantaged students (i.e., those who receive free/reduced-price lunch, FRPL), the share of disabled students (i.e., those who receive an individualized education plan, IEP), the share of a district's students who are racial/ethnic minorities (i.e., Black or Hispanic), geographic location indicators (i.e., urban, suburban, town, or rural), and total personal income (on a per-pupil basis in \$(2012)) for district residents. We also control for federal aid to school districts and revenues districts receive from other sources (not including state and local revenue). We include district fixed effects (θ_i) and cluster the standard errors at the district level to account for the interdependence of the error term within districts across time.

This regression specification allows us to estimate the impact of finance reform on the response of both high- and low-taxing districts with adequacy shortfalls, relative to

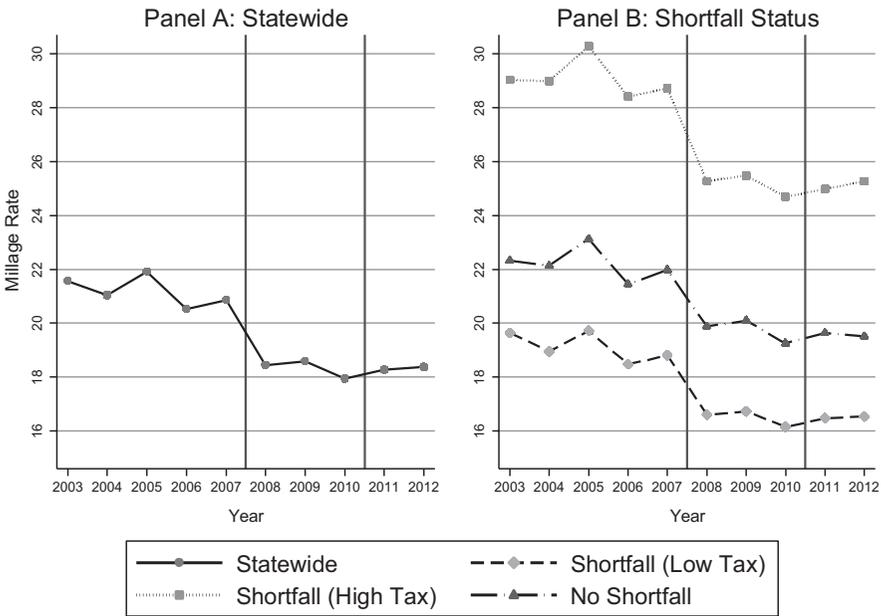
each other and to all Pennsylvania school districts that did not have adequacy shortfalls. This impact is reflected in both a level shift in local district response (captured by β_5 and β_8 for high-tax and low-tax districts with adequacy shortfalls, respectively) as well as a shift in the local response trend (captured by β_6 and β_9 for the high-tax and low-tax districts with adequacy shortfalls, respectively). For high-tax shortfall districts, the effect of statewide finance reform at the end of the first year (i.e., 2008–2009 school year) will be $\hat{\beta}_5 + \hat{\beta}_6$. Likewise, for low-tax shortfall districts, the effect of statewide finance reform at the end of the first year will be $\hat{\beta}_8 + \hat{\beta}_9$. Therefore, this approach allows us to map out the annual effect of statewide finance reform for both high- and low-tax shortfall districts in each of the three years in which the reform was in place.

This CITS strategy assumes that, in the absence of statewide finance reform, shortfall districts would have experienced the same change in local property tax effort (and other outcomes, such as education spending and district achievement) as the no-shortfall districts. Specifically, this approach assumes that deviations from prior district tax effort trends within the no-shortfall districts (i.e., the comparison group) provide a valid counterfactual for what would have happened to shortfall districts in the absence of statewide finance reform. This key identifying assumption is not violated by the presence of time-invariant district-specific traits or pre-finance reform trends related to shortfall (i.e., treatment) status. However, the internal validity of this CITS approach would be violated if there were determinants of our outcome measures that varied both contemporaneously with the introduction of statewide finance reform as well as uniquely with respect to shortfall status (Dee, Jacob, and Schwartz, 2013). For example, if the onset of the Great Recession, which was approximately contemporaneous with Pennsylvania's statewide finance reform effort, differentially affected the market value of taxable property — a key determinant of a district's equalized mill rate — based on a district's shortfall (and tax) status, then estimates of district tax effort would likely be biased. Further, if the onset of the Great Recession affected the ability of districts to collect property taxes (i.e., the property tax delinquency rate), and did so differently for districts based on their adequacy shortfall status, then estimates of district tax effort (based on the equalized mill rate) would be biased. We show later that neither the market value of taxable property nor property tax delinquency differed across shortfall and no-shortfall districts with the introduction of statewide finance reform, thus addressing these potential validity concerns related to the CITS strategy and the use of the equalized mill rate as a measure of district tax effort.

VII. RESULTS

Figure 3, Panel A presents the statewide trend in district tax effort over a 10-year period — five pre-policy years (2003–2004 through 2007–2008), the three years during which statewide finance reform was operative (2008–2009 through 2010–2011), and the two years after the state's finance reform was repealed (2011–2012 and 2012–2013). This depiction suggests that, on average, millage rates decreased by approximately 2.5 points (or approximately 13 percent) in the first post-policy (2008–2009) year, relative

Figure 3
Millage Rate



Notes: The year 2003 refers to the 2003–2004 school year. The millage rate is a standardized millage calculated by dividing a school district’s total taxes collected and remitted by its total market value as certified by the Pennsylvania State Tax Equalization Board. The vertical lines indicate the year statewide finance reform was introduced (2008–2009) and repealed (2011–2012). N=498 school districts.

to the pre-policy period. Further, this decline in the millage rate represents a structural shift in the average statewide millage rate, a shift that persisted throughout the reform period and into the post-reform period. We proceed by estimating the change in local district tax effort in the wake of statewide finance reform.

A. The Effect of Statewide Reform on District Tax Effort

The trends shown in Figure 3, Panel A suggest that the introduction of statewide finance reform may have had some negative effect on local tax effort. However, other state (and national) factors may have also affected districts’ efforts to support local education. Indeed, around the time of Pennsylvania’s statewide finance reform, state residents were beginning to experience the initial effects of the economic recession. Such economic conditions, even in the absence of statewide finance reform, may have led local districts to reduce the tax burden on their residents.

Our CITS approach aims to avoid the concern that broader economic conditions, and not statewide finance reform, were driving changes in the local tax effort made by school districts. The intuition is that the deviation from the pre-policy trend in tax effort among the comparison group (i.e., districts without shortfalls) will reflect other factors (such as economic conditions and other policy reforms) that may have influenced local district support for education even in the absence of statewide finance reform. Figure 3, Panel B shows the trends in district millage rate by district shortfall status. Evidence suggests that all districts experienced a decline in the millage rate in the first post-policy year (i.e., 2008–2009). However, while the decline was approximately equal in magnitude for low-tax districts with adequacy shortfalls compared with the no-shortfall districts, it appears that high-tax shortfall districts experienced a much larger decrease in the millage rate relative to comparison districts. This visual evidence suggests that statewide finance reform may have differentially affected the effort of shortfall districts based on their pre-reform tax effort.

Our regression-based estimates presented in Table 3 confirm the visual evidence from Figure 3, Panel B. We find that the effect of statewide finance reform on reductions in district tax effort was concentrated among the high-tax school districts with adequacy shortfalls. The reform led high-tax shortfall districts to decrease their tax-rate by a total of 1.4 mills at the end of the first year of the reform,³³ with no significant differences in the total effect by the end of the second or third years of statewide finance reform (i.e., a total effect of 1.3 and 1.2 mills at the end of the second and third years, respectively).³⁴ These estimates are statistically significant at conventional levels and are robust to the inclusion of district characteristics and district fixed effects. We do not, however, find any effect of statewide finance reform on the tax effort of low-tax shortfall districts in any of the three reform years.³⁵

The reduction in district tax effort has direct implications for local property tax revenue raised in support of education spending. Recall from (2) that the estimated property tax revenue a district collects equals the product of the district's equalized mill rate and its market value of taxable property. In the year prior to the introduction of statewide finance reform (i.e., 2007–2008 school year), the mean (per pupil) market value of taxable property for high-tax shortfall districts was \$283,321 (Table 2). Across

³³ The mill (tax) rate is the amount of tax payable per dollar of property value, and one mill is equal to one-thousandth of a dollar.

³⁴ The legislative review of the state budget occurs contemporaneously with the local school district budget process, generally from January to June of the preceding fiscal year (see online Appendix Figure A2). In each year of the reform period, school districts set their millage rates just prior to the state's final budget approval (but during the period of legislative deliberation over Act 61 phase in allocations). Because state share allocations were determined as part of the annual legislative budget process, districts were unable to precisely foresee future increases in state aid beyond the upcoming fiscal year. However, the reform was described from the beginning as a six-year process to gradually close 50 percent of the statewide adequacy gap (Rendell, 2008). Therefore, changes to district tax effort, concentrated in the first year of the Act 61 reform period, were informed by the expectation that the reform (and annual increases in state aid) would last for twice as long (six years) as it actually did (three years).

³⁵ See Table A4 for difference-in-difference estimates showing that our main CITS results are not sensitive to the linear functional form of the pre-policy outcome trends.

Table 3
Effect of Finance Reform on Tax Effort

	Equalized Mill Rate	
	(1)	(2)
<i>HighTax</i> × <i>Reform</i>	-1.60*** (0.28)	-1.53*** (0.29)
<i>HighTax</i> × (<i>Years_Since_Reform</i>)	0.08 (0.17)	0.12 (0.17)
<i>LowTax</i> × <i>Reform</i>	-0.24 (0.20)	-0.20 (0.20)
<i>LowTax</i> × (<i>Years_Since_Reform</i>)	0.25* (0.13)	0.28** (0.13)
<i>HighTax</i>		
Total effect (year 1)	-1.51*** (0.30)	-1.41*** (0.31)
Total effect (year 2)	-1.43*** (0.39)	-1.29*** (0.41)
Total effect (year 3)	-1.35** (0.53)	-1.18** (0.55)
<i>LowTax</i>		
Total effect (year 1)	0.01 (0.80)	0.08 (0.25)
Total effect (year 2)	0.26 (0.32)	0.36 (0.33)
Total effect (year 3)	0.51 (0.43)	0.64 (0.44)
P-value from F-test:		
$HT^{TotalEffect(Year1)}=LT^{TotalEffect(Year1)}$	0.000	0.000
$HT^{TotalEffect(Year2)}=LT^{TotalEffect(Year2)}$	0.000	0.000
$HT^{TotalEffect(Year3)}=LT^{TotalEffect(Year3)}$	0.000	0.000
District FE	X	X
District characteristics		X
Observations	3,984	3,984
Districts	498	498

Notes: Each column represents a separate regression. Coefficients (with robust standard errors clustered at the district level in parentheses) are reported. *HighTax* is a time-invariant indicator for whether a district had an adequacy shortfall and was a high-tax district; there are 92 such districts. *LowTax* is a time-invariant indicator for whether a district had an adequacy shortfall and was a low-tax district; there are 370 such districts. There are 36 districts without an adequacy shortfall. District characteristics include student enrollment; the proportion of FRPL, IEP, and minority students; geographic indicators; and total personal income (per-pupil, \$(2012)). All regressions include controls for federal aid and revenues from other sources (excluding state and local revenue) on a per-pupil \$(2012) basis. Asterisks denote significance at the 1% (***), 5% (**), and 10% (*) levels.

the three years of statewide finance reform, the average reduction in tax effort for high-tax shortfall districts (net of district fixed effects and time-varying characteristics) was 1.29 mills (Table 3). This reduction in tax effort corresponds to an estimated annual reduction in property tax revenue of \$365/pupil. Notably, this reduction in property tax revenue is approximately equal to the average annual state phase-in amount received by high-tax districts of \$381/pupil. Therefore, the estimated reduction in property tax revenue approximately offsets the amount of state phase-in aid provided to high-tax districts and reveals that equalization aid substituted for, rather than supplemented, local support of education spending among high-tax districts.³⁶ This tradeoff is particularly salient in this setting since Pennsylvania's finance reform did not require districts to maintain tax effort in support of education spending. Indeed, had high-tax districts with adequacy shortfalls not responded to statewide reform by providing additional property tax relief, they would have been able to raise additional revenue in support of education spending, relative to their district counterparts that were meeting adequacy targets.

B. Robustness Checks

The internal validity of the CITS identification strategy would be violated if there were unobserved determinants of district tax effort that varied both contemporaneously with the introduction of statewide finance reform and uniquely in either shortfall or no-shortfall districts (Dee, Jacob, and Schwartz, 2013). While we are unable to rule out the presence (or absence) of all time-specific and district-specific unobservable factors, we next present evidence that the two key determinants of district tax effort — property tax delinquency and the market value of taxable property — do not vary uniquely by shortfall status with the introduction of statewide finance reform (and, by extension, the Great Recession).

1. Property Tax Delinquency

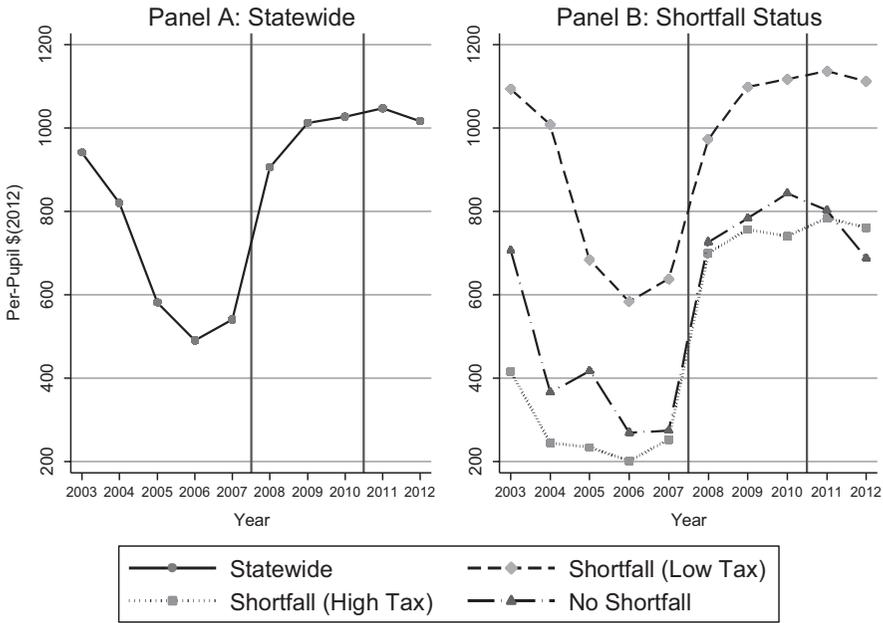
Our measure of district effort in support of education is the equalized millage rate, the ratio of property tax revenue collected to the market value of taxable property. If property tax delinquencies — the difference between property taxes payable to a school district and property taxes collected by that district in a given year — change at different rates across shortfall/no-shortfall districts, then estimates of the effect of statewide finance reform on district support for education will be biased. Using the quantities for property tax revenue (payable and collected) from (1) and (2), we calculate the amount of delinquent property tax revenue (on a per-pupil basis) for district i in school year t , as

$$(5) \quad PTR_{it}^{delinquent} = PTR_{it}^{payable} - PTR_{it}^{collected}.$$

Figure 4 provides evidence that trends in property tax delinquencies across district types are nearly identical; this is particularly true in the period just before and after the

³⁶ The magnitude of the crowding-out effect for high-tax districts — 96 cents per dollar of additional state aid transferred to property tax relief — is very similar to the crowding-out effect of 88–93 cents per dollar of additional state aid found in Lutz (2010).

Figure 4
Property Tax Delinquency

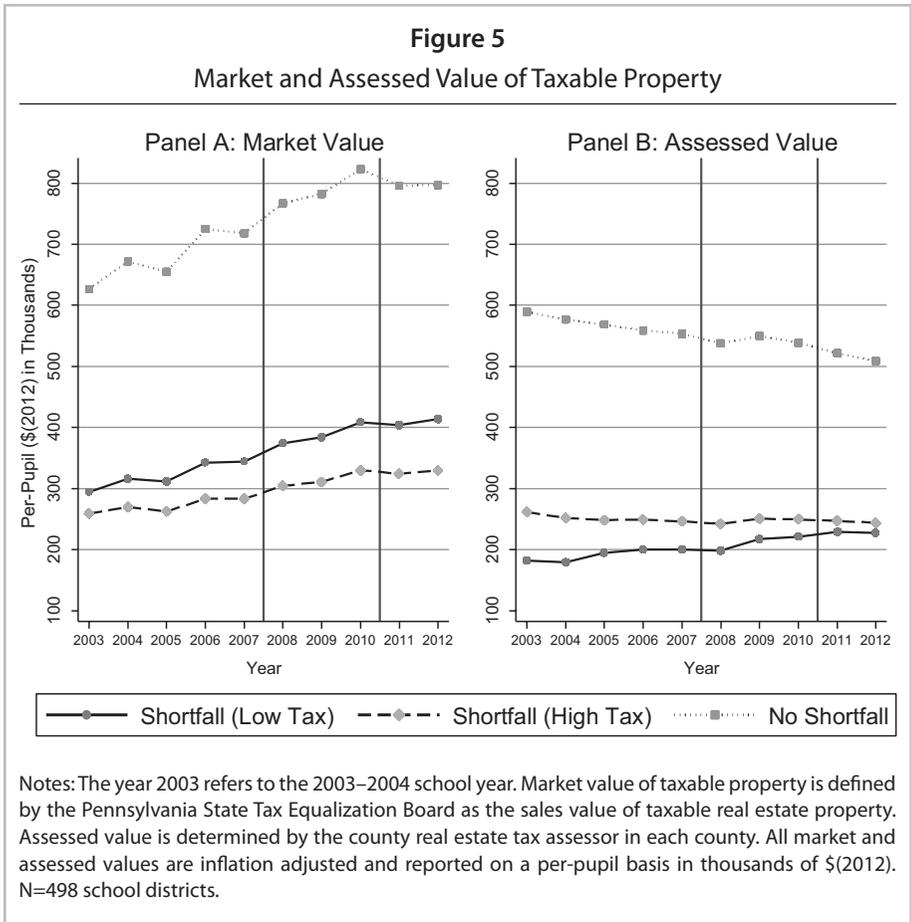


Notes: Authors’ calculations from data retrieved from the Pennsylvania Department of Education and the Pennsylvania State Tax Equalization Board. The year 2003 refers to the 2003–2004 school year. Property tax delinquency (per pupil) is inflation adjusted, reported in \$(2012) and is calculated as the difference between property taxes payable and property taxes collected in a given school year. The vertical lines indicate the year statewide finance reform was introduced (2008–2009) and repealed (2011–2012). N=498 school districts.

introduction of statewide finance reform in 2008.³⁷ Certainly, the dramatic increase in property tax delinquencies between the 2007–2008 and 2008–2009 school years reflects the onset of the Great Recession. However, evidence from Figure 4 indicates that this increase in delinquencies similarly affected each of the district types.

To further examine this visual evidence, we re-estimate (4) with $PTR_{it}^{delinquent}$ as the dependent variable. We find no evidence that property tax delinquency varied across

³⁷ We also note that if property tax delinquency were driving changes in the equalized millage rate, we would observe an increase in the millage rate over the 2003–2004 through 2006–2007 period, given that property tax delinquency decreased dramatically over this same time period. However, we do not observe an increase but rather a relatively stable trend in the equalized millage rate in this period (see Figure 3).



districts, by shortfall (and tax) status, with the introduction of statewide finance reform (see Columns 1 and 2, Table 4). Therefore, changes in district tax effort for districts meeting their adequacy targets and for high- and low-taxing districts falling short of their adequacy targets could not have been driven by differential changes in property tax delinquencies.

2. Market Value of Taxable Property

If the onset of the Great Recession differentially affected the market value of taxable property across district types, then the equalized mill rate would provide a biased measure of changes in district tax effort. For example, if the market value among no-shortfall districts was disproportionately and negatively affected by the onset of the Great

Table 4
Effect of Finance Reform on Property Tax Delinquency and
Market Value of Taxable Property

	Property Tax Delinquency		Market Value	
	(1)	(2)	(3)	(4)
<i>HighTax</i> × <i>Reform</i>	83.91 (105.87)	107.05 (129.76)	-6,058.41 (6,586.56)	-6,857.21 (7,274.4)
<i>HighTax</i> × (<i>Years_Since_Reform</i>)	-168.73 (113.66)	-130.08 (105.43)	8,433.96 (5,485.32)	4,514.91 (5,525.75)
<i>LowTax</i> × <i>Reform</i>	-14.46 (164.59)	-9.32 (182.17)	-5,087.56 (6,393.36)	-6,224.85 (7,100.25)
<i>LowTax</i> × (<i>Years_Since_Reform</i>)	-28.24 (115.99)	21.14 (151.96)	7,148.09 (5,390.82)	2,629.76 (5,505.52)
<i>HighTax</i>				
Total effect (year 1)	-84.82 (157.50)	-23.04 (162.89)	2,375.55 (4,266.62)	-2,342.30 (4,993.79)
Total effect (year 2)	-253.54 (254.82)	-153.12 (262.60)	10,809.51 (7,287.77)	2,172.62 (7,681.36)
Total effect (year 3)	-422.27 (362.09)	-283.20 (359.67)	19,243.48 (12,170.64)	6,687.53 (12,209.7)
<i>LowTax</i>				
Total effect (year 1)	-42.70 (213.52)	11.83 (373.96)	2,060.54 (4,041.04)	-3,595.09 (4,761.81)
Total effect (year 2)	-70.95 (354.74)	32.97 (329.67)	9,208.63 (7,062.69)	-965.32 (6,825.86)
Total effect (year 3)	-99.19 (443.60)	54.11 (541.08)	16,356.72 (11,897.76)	1,664.44 (11,769.4)
P-value from F-test:				
<i>HT</i> ^{TotalEffect(Year1)} = <i>LT</i> ^{TotalEffect(Year1)}	0.853	0.879	0.865	0.501
<i>HT</i> ^{TotalEffect(Year2)} = <i>LT</i> ^{TotalEffect(Year2)}	0.610	0.618	0.499	0.185
<i>HT</i> ^{TotalEffect(Year3)} = <i>LT</i> ^{TotalEffect(Year3)}	0.509	0.516	0.399	0.132
District FE	X	X	X	X
District characteristics		X		X
Observations	3,984	3,984	3,984	3,984
Districts	498	498	498	498

Notes: Each column represents a separate regression. Coefficients (with robust standard errors clustered at the district level in parentheses) are reported. Property tax delinquency and market value of taxable property are reported on a per-pupil basis in \$(2012). District characteristics include student enrollment; the proportion of FRPL, IEP, and minority students; geographic indicators; and total personal income (per-pupil, \$(2012)). All regressions include controls for federal aid and revenues from other sources (excluding state and local revenue) on a per-pupil \$(2012) basis. Asterisks denote significance at the 1% (***), 5% (**), and 10% (*) levels.

Recession but remained relatively unaffected among shortfall districts, our estimates of changes in the equalized mill rate would overstate the response of high-tax districts to the introduction of statewide finance reform. Figure 5 provides evidence that trends in the market value of taxable property (on a per-pupil basis) do not vary differentially with the introduction of statewide reform and with the contemporaneous onset of the Great Recession. Moreover, our regression-based estimates in Columns 3 and 4 of Table 4 confirm this visual evidence. Specifically, we find that the market value of taxable property does not differ across shortfall and no-shortfall (high and low-tax) districts with the introduction of finance reform in 2008–2009 nor over the three-year finance reform period.

3. *General Fund Balances*

Each school district carries a general fund that may be used to support current operations, including instruction-related expenditures, support services that provide administrative, guidance, and health-related support to students, and non-instructional services (including food services, student activities, community services, and scholarship and awards). The general fund includes tax revenues and other receipts that are not otherwise allocated to a special fund either by legal requirement or contractual agreement.³⁸ If a district's fund balance increased discontinuously in any given school year, this positive shock to available resources could provide districts with opportunities for property tax relief in the subsequent school year. Moreover, if trends in districts' general fund balances changed differentially across district types — high-tax and low-tax shortfall districts versus no-shortfall districts — in the years prior to statewide finance reform, any observed change in district effort (captured by the equalized millage rate) subsequent to the 2008 reform may reflect the sudden infusion of resources available to districts rather than changes in district effort in support of education.

We find that this is not the case. Figure 6 provides evidence that districts' general fund balances, while trending upward throughout the study period, did not increase discontinuously in the years prior to statewide finance reform. Therefore, any concern that discontinuous changes to districts' fund balances were driving differential changes in district tax effort are not supported by observed trends in fund balances across district types.

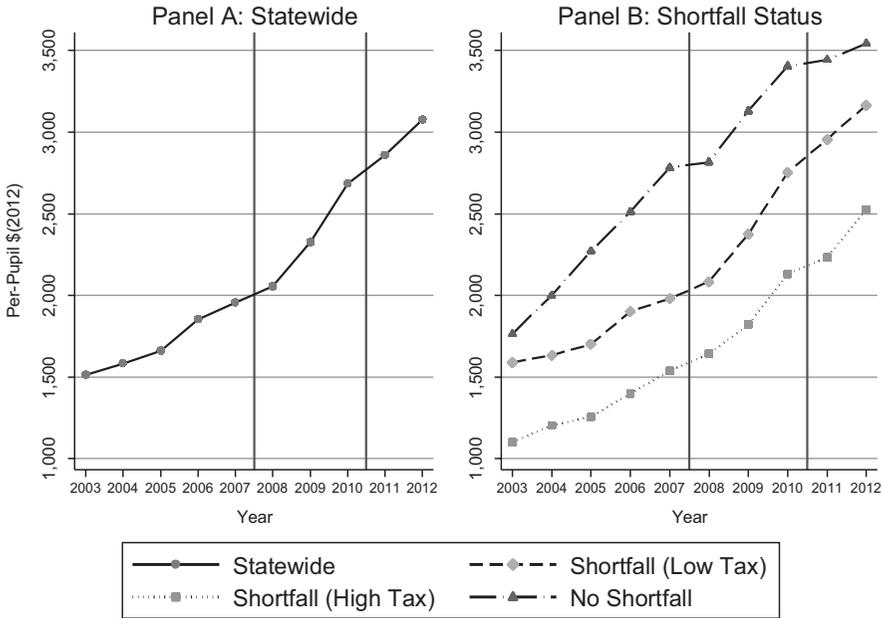
4. *Taxpayer Relief Act of 2006 (Act 1)*

During the period of study, the Special Session Act 1 of 2006, otherwise known as the Taxpayer Relief Act, provided property tax relief to Pennsylvania homeowners.³⁹ Act 1 sought to reduce local property taxes through the provision of additional state revenues, while also permitting increases to local income taxes to substitute for a portion of local property taxes. Act 1 also restricted the ability of school districts to increase

³⁸ Pennsylvania Department of Education, http://www.portal.state.pa.us/portal/server.pt/community/summaries_of_afr_data/7673/glossary_for_revenues/509037.

³⁹ Act of Jun. 27, 2006, Special Session 1, P.L. 1873, No. 1, Cl. 53.

Figure 6
General Fund Balance



Notes: The year 2003 refers to the 2003–2004 school year. General fund balance (per pupil) is inflation adjusted, reported in \$(2012), and is defined as the aggregate funds school districts hold not budgeted for use in the current school year. The vertical lines indicate the year statewide finance reform was introduced (2008–2009) and repealed (2011–2012). N=498 school districts.

local property taxes beyond prevailing inflation levels. Unlike Act 61, which provided additional state aid to districts based on their existing tax effort and educational spending levels, Act 1 did not provide additional property tax relief to school districts based on these criteria.

As a placebo test, we estimate the effect of Act 1 on district tax effort. To do so, we drop the finance reform period (2008–2009 through 2010–2011 years) and re-estimate (4). We find that, in the wake of Act 1, district tax effort declined for all district types during the 2006–2007 school year (Figure 3). Notably, we find that Act 1 did not differentially affect the tax effort of high-tax shortfall school districts compared with their no-shortfall counterparts after the first year of Act 1 in the 2006–2007 school year (Table 5). Indeed, high-tax shortfall districts responded in a manner similar to districts meeting their adequacy targets, with both district types reducing their tax effort by a similar amount.⁴⁰ Further, we find a significant difference in how high-tax and low-tax shortfall

⁴⁰ Low-tax shortfall districts increased their tax effort by 0.84 mills in the first year (2006–2007) of Act 1.

Table 5
Effect of Act 1 on Tax Effort in Pre-Reform Period (2003–2004; 2007–2008)

	Equalized Mill Rate	
	(1)	(2)
<i>HighTax</i> × <i>Act1</i>	0.05 (0.30)	0.20 (0.31)
<i>HighTax</i> × (<i>Years_Since_Act1</i>)	-0.45* (0.27)	-0.56** (0.28)
<i>LowTax</i> × <i>Act1</i>	0.68*** (0.22)	0.77*** (0.25)
<i>LowTax</i> × (<i>Years_Since_Act1</i>)	0.15 (0.20)	0.07 (0.23)
<i>HighTax</i>		
Total effect (year 1, 2006–2007)	-0.40 (0.34)	-0.36 (0.34)
Total effect (year 2, 2007–2008)	-0.85 (0.53)	-0.92* (0.54)
<i>LowTax</i>		
Total effect (year 1, 2006–2007)	0.84*** (0.27)	0.84*** (0.27)
Total effect (year 2, 2007–2008)	0.99** (0.42)	0.90** (0.44)
P-value from F-test:		
<i>HT</i> TotalEffect(Year1)= <i>LT</i> TotalEffect(Year1)	0.00	0.00
<i>HT</i> TotalEffect(Year2)= <i>LT</i> TotalEffect(Year2)	0.00	0.00
District FE	X	X
District characteristics		X
Observations	2,490	2,490
Districts	498	498

Notes: Each column represents a separate regression. Coefficients (with robust standard errors clustered at the district level in parentheses) are reported. *Act1* indicates Pennsylvania's Taxpayer Relief Act and equals one in the 2006–2007 and 2007–2008 years and zero in the 2003–2004 through 2005–2006 period. *HighTax* is a time-invariant indicator for whether a district had an adequacy shortfall and was a high-tax district; there are 92 such districts. *LowTax* is a time-invariant indicator for whether a district had an adequacy shortfall and was a low-tax district; there are 370 such districts. There are 36 districts without an adequacy shortfall. District characteristics include student enrollment; the proportion of FRPL, IEP, and minority students; geographic indicators; and total personal income (per-pupil, \$(2012)). All regressions include controls for federal aid and revenues from other sources (excluding state and local revenue) on a per-pupil \$(2012) basis. Asterisks denote significance at the 1% (***), 5% (**), and 10% (*) levels.

districts responded in the wake of Act 1 (Table 5). By the 2007–2008 school year — two years after Act 1 and the year prior to Act 61 — high-tax districts reduced their tax effort (by approximately 1 mill) while low-tax districts increased their tax effort by approximately 1 mill (with almost all of the increase occurring in the 2006–2007 school year).

Given the differential tax response to Act 1 by high-tax and low-tax shortfall districts, we would not expect high-tax districts to further reduce their tax effort under Act 61. However, high-tax districts in fact reduced their tax effort significantly more than districts without adequacy shortfalls. Moreover, we would expect low-tax districts, who increased their tax rate in the two years after Act 1, to use some (if not all) of the additional state aid under Act 61 as property tax relief. However, low-tax districts did not respond differently than no-shortfall districts under Act 61. In addition, while we might have expected greater property tax reductions for high-tax districts under Act 1, a reform targeting local property tax reduction, we find greater reductions in property tax effort for these districts as a result of Act 61. These results further suggest that the receipt of state equalization aid under Act 61 generated a larger negative response than was observed under a tax relief policy (Act 1) that did not target districts based on prior tax effort or adequate spending levels.

C. Expenditure and Achievement Effects of Statewide Finance Reform

Did the introduction of statewide finance reform affect education spending? To provide insight into this question, we re-estimate (4) with a measure of (per-pupil) education spending in district i during school year t as the dependent variable. We consider changes to total (per-pupil) district spending, which is inclusive of spending on instruction, support services, non-instructional services, facilities acquisition, and other financing uses (such as debt service). We also consider changes to the following three categories of district spending: (1) instruction-related spending, which includes expenditures for activities dealing directly with the interaction between teachers and students and costs related to the activities of aides or classroom assistants who assist in the instructional process; (2) support services, which include expenditures for services that provide administrative, technical (such as guidance and health), and logistical support to facilitate and enhance instruction; and (3) non-instructional services, which include expenditures on food services, student activities, community services, and scholarships and awards. All finance variables (i.e., revenues districts receive from federal, local, and other sources) are inflation-adjusted and reported in per-pupil \$(2012), and all district demographic variables are defined as in (4).

Our results, in Columns 1 and 2 of Table 6, suggest that statewide finance reform had no significant (or substantive) effect on total (per-pupil) spending, either for high-tax or low-tax districts spending below state-defined adequacy levels. Moreover, there is no difference in instruction-related spending between high- and low-tax districts with shortfalls compared with their no-shortfall district counterparts (see Columns 3 and 4, Table 6), nor is there any evidence of differential effects on support service spending (see Columns 5 and 6, and Table 6). While there is no evidence of differential effects

Table 6
Effect of Finance Reform on Education Spending

	Total Spending			Instruction			Support Services			Non-Instructional Services		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	
<i>HighTax</i> × Reform	239.04 (158.44)	215.74 (153.76)	85.15 (83.75)	70.87 (81.29)	143.74** (67.08)	138.06** (64.01)	1.76 (15.11)	1.87 (15.21)				
<i>HighTax</i> × (Years_Since_Reform)	-138.88 (114.24)	-170.64 (111.04)	-52.72 (69.44)	-69.48 (66.64)	-52.82 (40.06)	-66.53* (39.019)	18.11** (8.44)	16.74* (8.65)				
<i>LowTax</i> × Reform	117.29 (133.16)	91.54 (127.07)	7.68 (69.41)	-10.30 (66.85)	58.43 (61.04)	52.46 (57.69)	-16.11 (13.79)	-16.09 (13.83)				
<i>LowTax</i> × (Years_Since_Reform)	-99.21 (105.54)	-121.97 (102.33)	-27.09 (62.09)	-34.44 (59.14)	1.35 (34.33)	-14.35 (33.71)	26.53*** (7.34)	25.02*** (7.39)				
<i>HighTax</i> Total Effect (year 1)	100.16 (174.36)	45.10 (170.46)	32.43 (76.45)	1.39 (43.94)	90.92 (69.12)	71.53 (66.99)	19.87* (10.40)	18.61* (10.45)				
Total Effect (year 2)	-38.71 (273.75)	-125.54 (246.21)	-20.28 (117.11)	-68.09 (116.78)	38.10 (89.80)	4.99 (157.90)	37.98*** (11.41)	35.35*** (11.71)				
Total Effect (year 3)	-177.59 (348.28)	-296.18 (339.74)	-73.00 (177.06)	-137.58 (174.73)	-14.72 (147.20)	-61.54 (120.69)	56.09*** (17.18)	52.09*** (17.73)				

Table 6 (Continued) Effect of Finance Reform on Education Spending

	Total Spending		Instruction		Support Services		Non-Instructional Services	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
<i>LowTax</i>								
Total Effect (year 1)	18.08 (180.80)	-30.44 (152.18)	-19.41 (64.70)	-44.74 (64.58)	59.78 (62.32)	38.11 (60.25)	10.42 (9.47)	8.92 (9.46)
Total Effect (year 2)	-81.13 (234.19)	-152.41 (232.42)	-46.50 (106.68)	-79.19 (103.98)	61.13 (80.27)	23.75 (79.17)	36.94*** (9.81)	33.94*** (9.84)
Total Effect (year 3)	-180.33 (329.24)	-274.38 (321.14)	-73.59 (160.58)	-113.63 (156.08)	62.48 (105.61)	9.40 (93.99)	63.47*** (14.52)	58.96*** (14.61)
P-value from F-test:								
$HT_{TotalEffect(Year1)}=LT_{TotalEffect(Year1)}$	0.342	0.387	0.246	0.303	0.363	0.327	0.082	0.076
$HT_{TotalEffect(Year2)}=LT_{TotalEffect(Year2)}$	0.680	0.793	0.667	0.855	0.626	0.689	0.883	0.849
$HT_{TotalEffect(Year3)}=LT_{TotalEffect(Year3)}$	0.984	0.873	0.995	0.787	0.244	0.276	0.513	0.567
District FE	X	X	X	X	X	X	X	X
District characteristics		X		X		X		X
Observations	3,984	3,984	3,984	3,984	3,984	3,984	3,984	3,984
Districts	498	498	498	498	498	498	498	498

Notes: Each column represents a separate regression. Coefficients (with robust standard errors clustered at the district level in parentheses) are reported. All spending variables are reported on a per-pupil basis in \$(2012). Total spending includes expenditures on instruction, support services, non-instructional services, facilities acquisition, and other financing uses (such as debt service). Instruction spending includes expenditures for activities dealing directly with the interaction between teachers and students and includes the activities of aides or classroom assistants of any type who assist in the instructional process. Support services include expenditures for services that provide administrative, technical (such as guidance and health), and logistical support to facilitate and enhance instruction. Non-instructional services include expenditures for food services, student activities, community services, and scholarships and awards. District characteristics include student enrollment; the proportion of FRPL, IEP, and minority students; geographic indicators; and total personal income (per-pupil, \$(2012)). All regressions include controls for local, federal, and other revenues. Asterisks denote significance at the 1% (***) level, 5% (**), and 10% (*) levels.

Table 7
Effect of Finance Reform on Achievement

	Reading Achievement		Math Achievement	
	(1)	(2)	(3)	(4)
<i>HighTax</i> × <i>Reform</i>	0.71 (0.49)	0.65 (0.48)	1.25** (0.61)	1.31** (0.61)
<i>HighTax</i> × (<i>Years_Since_Reform</i>)	-0.54 (0.43)	-0.70 (0.45)	-1.37** (0.54)	-1.31** (0.55)
<i>LowTax</i> × <i>Reform</i>	0.54 (0.39)	0.45 (0.38)	0.61 (0.53)	0.67 (0.52)
<i>LowTax</i> × (<i>Years_Since_Reform</i>)	-0.25 (0.35)	-0.39 (0.37)	-0.81** (0.40)	-0.74* (0.42)
<i>HighTax</i>				
Total effect (year 1)	0.17 (0.53)	-0.05 (0.49)	-0.12 (0.71)	0.00 (0.15)
Total effect (year 2)	-0.37 (0.84)	-0.75 (0.85)	-1.49 (1.07)	-1.31 (1.10)
Total effect (year 3)	-0.92 (1.22)	-1.45 (1.26)	-2.86* (1.55)	-2.62* (1.59)
<i>LowTax</i>				
Total effect (year 1)	0.29 (0.42)	0.06 (0.42)	-0.20 (0.57)	-0.06 (0.65)
Total effect (year 2)	0.04 (1.37)	-0.33 (0.70)	-1.01 (0.84)	-0.80 (0.87)
Total effect (year 3)	-0.20 (1.02)	-0.72 (1.04)	-1.82 (1.19)	-1.54 (1.23)
P-value from F-test:				
$HT^{TotalEffect(Year1)}=LT^{TotalEffect(Year1)}$	0.762	0.792	0.880	0.895
$HT^{TotalEffect(Year2)}=LT^{TotalEffect(Year2)}$	0.490	0.492	0.544	0.528
$HT^{TotalEffect(Year3)}=LT^{TotalEffect(Year3)}$	0.411	0.404	0.370	0.358
District FE	X	X	X	X
District characteristics		X		X
Observations	2,958	2,958	2,958	2,958
Districts	493	493	493	493

Notes: Each column represents a separate regression. Coefficients (with robust standard errors clustered at the district level in parentheses) are reported. Reading (math) achievement is the proportion of a district's students meeting or exceeding state academic proficiency standards on the reading (math) portion of the Pennsylvania System of School Assessment (PSSA). Reading and math achievement are available for the 2005–2006 through 2010–2011 school years. District characteristics include student enrollment; the proportion of FRPL, IEP, and minority students; geographic indicators; and total personal income (per-pupil, \$(2012)). All regressions include controls for local, federal, and other revenues. Asterisks denote significance at the 1% (***) , 5% (**), and 10% (*) levels.

on non-instructional service spending between high-tax and low-tax shortfall districts, these districts increased spending by \$52-\$59 per-pupil by the third year of the reform, compared to their no-shortfall counterparts (see Columns 7 and 8, and Table 6). These findings suggest that the provision of lump-sum equalization grants to shortfall districts under statewide finance reform had no discernible effect on education expenditures.

Given that reductions in tax effort supplanted any gains in education spending for high-tax shortfall districts, we might expect there to be no additional educational benefits in terms of improved achievement for these districts. This is indeed what we find. Table 7 summarizes the achievement effects of statewide finance reform for both reading and math achievement. Re-estimating model (4) with the proportion of students meeting or exceeding proficiency standards on state reading exams, we find no statistically (or substantively) meaningful differences in reading achievement across the three district types in each of the three reform years (see Columns 1 and 2, Table 7). For math, while there is no significant difference in achievement across shortfall and no-shortfall districts, there is some (marginally statistically significant) evidence of decreases in achievement for high-tax districts. These results suggest that, at best, the introduction of finance reform did not improve cross-district achievement disparities and, at worst, may have increased the (math) achievement disparity between high-tax shortfall districts and no-shortfall districts by the third year of the reform.

It is noteworthy (if only suggestive) that spending and achievement decline monotonically during the reform period for both high- and low-tax shortfall districts, relative to no-shortfall districts. Among high-tax districts, total spending differences declined continuously over the three-year reform period, from \$45 in 2008–2009 to \$296 by 2010–2011; at the same time, math (reading) proficiency, which did not differ by the end of the 2008–2009 school year, declined by 2.6 (1.5) percentage points by the end of the 2010–2011 school year. We find very similar patterns of declining spending and achievement among low-tax shortfall districts. Further, the relative decline in total spending for high- and low-tax districts was driven by declines in instruction-related spending and spending on support services. While these results do not imply that changes in spending caused changes in achievement among shortfall districts, they are suggestive of what has been found more broadly in the literature examining the effect of educational spending on achievement (Card and Payne, 2002; Papke, 2005; Jackson, Johnson, and Persico, 2014).

VIII. CONCLUSION

In the 2008–2009 school year, Pennsylvania instituted statewide finance reform aimed at increasing education spending and improving the relative standing of districts spending below state-determined adequacy levels. The state's reform effort provided modest equalization aid to shortfall districts based on their prior tax effort. The reform did not, however, mandate that districts maintain their pre-reform tax effort in support of education spending, nor was the intent of the policy that equalization aid be used for property tax relief. The reform effort, while short-lived, provides an opportunity to

examine the extent to which districts may differentially respond to statewide finance reform — such as whether districts that differ in their local tax effort maintain their pre-reform effort in support of education. Moreover, this policy change allows us to examine the consequences of heterogeneous changes in tax effort on district spending and achievement.

We find that the introduction of school finance reform resulted in larger property tax reductions for high-tax shortfall districts than for districts spending above adequate levels that received no additional equalization aid under the reform. Moreover, there is no evidence that the introduction of finance reform increased district spending for shortfall districts or improved their academic performance. Taken together, these results indicate that the state's finance reform effort did not reduce cross-district spending or achievement disparities.

The use of equalization aid for property tax relief was not the stated intent of Pennsylvania's statewide finance reform. However, the fact that high-tax school districts with adequacy shortfalls reduced their effort in support of education is not an unexpected consequence of finance reform, particularly in the case of a reform providing unrestricted equalization grants. Our findings support prior empirical evidence that, when the ability of school districts to reduce their property tax rate is unconstrained by state policy, increases in intergovernmental aid will be coupled with property tax relief for district residents (Fisher and Papke, 2000; Gordon, 2004; Lutz, 2010). In the process, equalization aid will substitute for, rather than supplement, local support of education spending.

To what extent is the differential tax effort response to finance reform by high- and low-tax districts due to either (1) differences in the magnitude of the treatment — the state phase-in (what could be referred to as policy design), or (2) heterogeneity in the behavioral response to the same treatment? For the differential response to be the result of policy design, any change in tax effort must occur in a setting where there are heterogeneous treatments (i.e., different phase-in amounts) for homogeneous groups (i.e., districts with relatively similar pre-policy tax effort). On the contrary, if there are heterogeneous groups (i.e., high- and low-tax districts) that are provided with homogenous treatments (i.e., the same phase-in amount), then any change in district tax effort must be a behavioral response (observable district characteristics, such as pre-policy tax effort, moderating the treatment effect of the phase-in). In this setting, we observe heterogeneous groups and heterogeneous treatments. However, the treatment differences across the two groups are quite modest. Indeed, the phase-in amounts provided to high- and low-tax districts differed at most by \$155/pupil, on average, in year two and as little as \$65/pupil, on average, in year three. As a result, we would consider the treatments (approximately) homogenous. Therefore, the evidence in this particular setting suggests that the differential response (i.e., the reduction in district tax effort) to the introduction of finance reform, which we find to be large in magnitude, is likely due to heterogeneity in the behavioral response to quite similar treatments, rather than a result of the policy design.

Similar to Lutz (2010), who examined the effect of statewide school finance reform in a particular setting (New Hampshire), we focused our analysis on the Pennsylvania case. Unlike previous analyses of statewide finance reform (e.g., Papke, 2005), the timeline

of Pennsylvania's reform runs directly through the period of the Great Recession. In addition, the Pennsylvania reform was short-lived, lasting just three years. The short duration of Pennsylvania's Act 61 reform and its overlap with the Great Recession offer both benefits and limitations in the degree to which our results may be generalizable.

With respect to the Great Recession, our empirical analyses control for state-level recessionary effects common to all Pennsylvania districts, and we show that internal validity is not threatened by the onset of the recession. Yet, given our prediction that the degree of tax relief will depend on the extent to which districts are credit constrained, all Pennsylvania districts were more credit constrained during the reform period, as evidenced by the rise in property tax delinquency. As a result, we would expect districts to provide less property tax relief (for every additional dollar of state aid) during the reform period than in non-recessionary years when district budgets are less constrained.

With respect to the short duration of Act 61, we do not view this as a drawback of our analysis. We assume that Pennsylvania's school districts were, at the onset of Act 61, unaware that the reform effort would be repealed after just three years. If true, then it follows that in the short-run we would not expect a differential response compared to other settings where state reforms are longer-lasting. Indeed, as previously described, the mandate of Act 61 was to close half of the state's adequacy gap over (a minimum of) six years. Furthermore, the short duration of Act 61 suggests that the results reflect a greater degree of crowd-out (and diminished flypaper) effects compared to settings where statewide finance reform remains in place for a longer period of time. And, given the short duration of Act 61, coupled with decreased residential mobility for homeowners resulting from the Great Recession, we would expect to observe little in terms of general equilibrium effects resulting from Tiebout-type sorting. Together, these stylized facts suggest that we have observed the short-run effects of an unconditional intergovernmental transfer during a period of constrained district budgets and low residential mobility.

Finally, these findings have important policy implications for the current education finance climate in Pennsylvania. Our results point to the important role that district response can play in moderating the influence of additional grant aid. Indeed, if finance reform efforts in Pennsylvania (and other states) are dedicated to increasing district spending as well as reducing the spending gap between property-rich school districts and their less-advantaged counterparts, then consideration must be given to both the magnitude of equalization aid provided to districts and maintenance of effort requirements that limit the transfer of state aid to property tax relief.

ACKNOWLEDGMENTS AND DISCLAIMERS

The authors thank Eric Brunner, Andrew Reschovsky, Jesse Rothstein, three anonymous reviewers, the editors George Zodrow and William Gentry, and participants at the Association for Education Finance and Policy 2015 conference and the National Tax Association 108th annual conference for valuable feedback on earlier versions of this paper. The authors thank Rachel Ascoli and Thomas Szczesny for excellent research assistance and Jennifer Moore for editorial assistance.

DISCLOSURES

Steinberg and Quinn acknowledge funding from the University of Pennsylvania Research Foundation and a grant from the Milken Strategic Faculty Support Fund.

REFERENCES

- Augenblick, Palaich and Associates, Inc., 2007. *Costing Out the Resources Needed to Meet Pennsylvania's Public Education Goals*. Augenblick, Palaich and Associates, Inc., Denver, CO.
- Card, David, and A. Abigail Payne, 2002. "School Finance Reform, the Distribution of School Spending, and the Distribution of Student Test Scores." *Journal of Public Economics* 83 (1), 49–82.
- Chakrabarti, Rajashri, Max Livingston, and Joydeep Roy, 2014. "Did Cuts in State Aid During the Great Recession Lead to Changes in Local Property Taxes?" *Education Finance and Policy* 9 (4), 383–416.
- Corcoran, Sean P., and William N. Evans, 2015. "Equity, Adequacy, and the Evolving State Role in Education Finance." In Ladd, Helen F., and Margaret E. Goertz (eds.), *Handbook of Research in Education Finance and Policy, Second Edition*, 353–375. Routledge, New York, NY.
- Cromwell, Erich, and Keith Ihlanfeldt, 2015. "Local Government Responses to Exogenous Shocks in Revenue Sources: Evidence from Florida." *National Tax Journal* 68 (2), 339–376.
- Dee, Thomas S., and Brian Jacob, 2011. "The Impact of No Child Left Behind on Student Achievement." *Journal of Policy Analysis and Management* 30 (3), 418–446.
- Dee, Thomas S., Brian Jacob, and Nathaniel L. Schwartz, 2013. "The Effects of NCLB on School Resources and Practices." *Educational Evaluation and Policy Analysis* 35 (2), 252–279.
- Dye, Richard F., and Andrew Reschovsky, 2008. "Property Tax Responses to State Aid Cuts in the Recent Fiscal Crisis." *Public Budgeting & Finance* 28 (2), 87–111.
- Fisher, Ronald C., and Leslie E. Papke, 2000. "Local Government Responses to Education Grants." *National Tax Journal* 53 (1), 153–168.
- Gordon, Nora, 2004. "Do Federal Grants Boost School Spending? Evidence from Title I." *Journal of Public Economics* 88 (9–10), 1771–1792.
- Hanushek, Eric A., and Alfred A. Lindseth, 2009. *Schoolhouses, Courthouses, and Statehouses: Solving the Funding-Achievement Puzzle in America's Public Schools*. Princeton University Press, Princeton, NJ.
- Hoxby, Caroline M., 2001. "All School Finance Equalizations Are Not Created Equal." *Quarterly Journal of Economics* 116 (4), 1189–1231.
- Jackson, C. Kirabo, Rucker Johnson, and Claudia Persico, 2014. "The Effect of School Finance Reforms on the Distribution of Spending, Academic Achievement, and Adult Outcomes." NBER Working Paper No. 20118. National Bureau of Economic Research, Cambridge, MA.

Jackson, C. Kirabo, Rucker C. Johnson, and Claudia Persico, 2015. "The Effects of School Spending on Educational and Economic Outcomes: Evidence from School Finance Reforms." NBER Working Paper No. 20847. National Bureau of Economic Research, Cambridge, MA.

Ladd, Helen F., Rosemary Chalk, and Janet S. Hansen (eds.), 1999. *Equity and Adequacy in Education Finance: Issues and Perspectives*. National Academy Press, Washington, DC.

Leachman, Michael, and Chris Mai, 2014. *Most States Still Funding Schools Less than Before the Recession*. Center on Budget and Policy Priorities, Washington, DC.

Lutz, Byron, 2010. "Taxation with Representation: Intergovernmental Grants in a Plebiscite Democracy." *Review of Economics and Statistics* 92 (2), 316–332.

McGuire, Therese J., Leslie E. Papke, and Andrew Reschovsky, 2015. "Local Funding of Schools: The Property Tax and Its Alternatives." In Ladd, Helen F., and Margaret E. Goertz (eds.), *Handbook of Research in Education Finance and Policy, Second Edition*, 376–391. Routledge, New York, NY.

Nguyen-Hoang, Phuong, and Yilin Hou, 2014. "Local Fiscal Responses to Pro-cyclical Changes in State Aid." *Publius* 44 (4), 587–608.

Papke, Leslie E., 2005. "The Effects of Spending on Test Pass Rates: Evidence from Michigan." *Journal of Public Economics* 89 (5–6), 821–839.

Rendell, Edward G., 2008. "Fiscal Year 2008–2009 Budget Address of Governor Edward G. Rendell." *Commonwealth of Pennsylvania, Legislative Journal*, Session of 2008, 192nd of the General Assembly. No 10, p. 334.

Roy, Joydeep, 2011. "Impact of School Finance Reform on Resource Equalization and Academic Performance: Evidence from Michigan." *Education Finance and Policy* 6 (2), 137–167.

Steinberg, Matthew P., and Rand Quinn, 2015. "A Tale of Two Decades: New Evidence on Adequacy and Equity in Pennsylvania." *Journal of Education Finance* 40 (3), 273–299.

Steinberg, Matthew P., and Lauren Sartain, 2015. "Does Teacher Evaluation Improve School Performance? Experimental Evidence from Chicago's Excellence in Teaching Project." *Education Finance and Policy* 10 (4), 535–572.

Superfine, Benjamin M., 2010. "Court-Driven Reform and Equal Educational Opportunity: Centralization, Decentralization, and the Shifting Judicial Role." *Review of Educational Research* 80 (1), 108–137.

U.S. Department of Education, 2013. *For Each and Every Child: A Strategy for Education Equity and Excellence*. The Equity and Excellence Commission, Washington, DC.

Wang, Wen, William D. Duncombe, and John M. Yinger, 2011. "School District Responses to Matching Aid Programs for Capital Facilities: A Case Study of New York's Building Aid Program." *National Tax Journal* 64 (3), 759–794.