Effect of Constraints on Tiebout Competition:

Evidence from some School Finance Reforms in the U.S[*]

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1 Introduction

Local financing of public schools has been one of the distinguishing features of the K-12 educational system in the U.S. A substantial share of the total funds for educational expenditures is raised at the local school district level, primarily by taxes levied on property, where the level of the property tax rate is chosen by local residents in an election, just like elections for the local school board.[1] The other sources of school revenue have been state aid and federal aid. State aid has been the more important of the two, with federal aid generally accounting for around 10 percent of the average per pupil spending and has remained more or less unchanged at that level for the last few decades.

This reliance on local tax revenues leads to a bundling of two distinct choices - residential choice and school choice. Parents in the U.S. often choose their residences on the basis of the quality of schools in the locality. Since, as is often argued, demand for (and affordability of) a good education increases with parental income and educational attainment, this often results in a Tiebout type sorting families with similar demands congregate together, leading to economic and demographic segregation across school districts within a state. Households voting with their feet have led to the formation of property-rich and property-poor communities, with the result that wealthy school districts have been able to spend more money per student than poor districts.

A school finance reform, loosely interpreted as an equalization of school finances within state boundaries, can in principle weaken this link between residence choice and demand for schooling. Such reforms have mostly been implemented following adverse court decisions, ruling existing financing systems unconstitutional, but have also sometimes initiated by the

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[1] For example, in 1999-2000, the share of revenues for public elementary and secondary schools that was raised locally was 43.2% (National Center for Education Statistics, 2003, Table 156). This percentage would have been even greater in earlier years, when most states had not passed school finance reforms.

respective legislatures independently. These typically increase the state share of K-12 revenues, mostly by giving large sums of money to the lowest spending school districts, in an effort to reduce the prevailing disparities in per pupil spending across districts within the state.

One important aspect of many of these school reforms is their effect on local discretion over school spending. In an effort to reduce spending inequalities across districts, several states have implemented school finance reforms that either severely limit or end altogether local discretion. This diminished local control over local government activities schooling in this case has significant implications for the provision of public education. The original Tiebout framework highlights the fact that centralization of public services at higher levels may reduce efficiencies associated with providing these services at the local level, possibly undermining the conformity between citizen preferences and the services provided. However, though other aspects of school finance reforms have been much studied in the literature, the effect of these reforms on spending and performance, operating via their effect on constraints on local discretion, has been neglected so far (except Roy (2009))[2]. This paper is aimed at filling this gap.

We first set up a simple theoretical model that captures the basic features of school finance reforms and a typical pre-reform scenario. The objective is to examine incentives and responses of school districts facing school finance reforms and contrast them with those in the pre-reform scenario. In this framework public school quality is related to the effort expended by school officials and each school district chooses effort to maximize its net revenue, while recognizing that it can affect local revenue through property values, since a higher school quality increases the demand for its schools and increases property values. The theoretical model predicts that for high spending school districts, equilibrium public school effort will be lower under the school

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[2] In a recent paper, Roy (2009) studies some of these issues in the context of Michigan.

finance program than in the pre-program scenario, and that in the post-program equilibrium, effort of high spending districts facing greater loss of local discretion will be less than ones facing less loss of discretion.

We next examine these issues in the context of school finance reforms in California, Michigan and Vermont. California was the first state to implement a comprehensive school finance reform in the 1970s, and it is also the state which put the most severe constraints on school spending, abolishing local discretion completely. Michigan is also an interesting case, as the school finance reform it passed in 1994, called Proposal A, also practically ended local control over amount of school spending, though there was not a drastic leveling down as was the case in California. Finally, in Vermont, the Equal Educational Opportunity Act (Act 60), which was implemented in 1997, combined a foundation grant program with a power equalization formula that required property tax rates to vary with local wealth this scenario affords us the opportunity to study a state which did not abolish local discretion as such but instead changed the incentives, leading to significant differences in the tax price of schooling among various districts, so that the power of local discretion became much more blunt that earlier. Taken together, the differences in the nature and extent of restraints put on educational spending in these three states affords us a unique opportunity to study the implications for the quality of local public service provision in states that intervene to limit local government control.

2 School Finance Reforms

2.1 California

California is perhaps the most canonical case of school finance reform, having completely changed its school finance structure over the last four decades. In 1970, the system was financed locally, with school districts raising more than half of their revenue by taxing local

property. School districts levied their own property tax rates, subject to the approval of their voters. The state supplemented that revenue with foundation aid. Basically, the state ensured that each school district had enough revenue to attain a basic level of spending, known as foundation level. Each district was responsible for a share of the foundation level-a share determined by applying a state-specified tax rate to the district's assessed value. The state in turn was responsible for the difference between the foundation level and the local share. However, because the property tax base differed dramatically across school districts, this system resulted in significant disparities in education spending across districts.

These disparities were the cause of a lawsuit filed in 1968 by the Western Center on Law and Poverty, called Serrano v. Priest. The Serrano plaintiffs maintained that the system was inequitable and thus in violation of the equal protection clause of the Fourteenth Amendment. The California Supreme Court agreed, in a series of decisions during the 1970s (Serrano I and Serrano II), and ruled that the finance system was also in violation of the California constitution. The Court asserted that differences in property tax revenue per pupil across districts could not be related to differences in the property wealth of those districts. This set off a series of legislative and popular initiatives to bring the state into compliance.

The state responded to the Serrano decisions by placing ceilings on the amount districts could spend on their students and by having high-spending districts increase their spending at a lower rate than that of low-spending districts. The lowest-spending districts were permitted to increase their spending at rates of 15 percent, while the highest-spending districts were held to less than 3 percent. This difference in growth rates would cause revenue limits, and hence per pupil spending, to converge over time. Soon after, the passage of Proposition 13, the property tax limitation initiative, in 1978 moved the responsibility for financing public schools from the local to the state level.

The combination of the Serrano rulings and Proposition 13 significantly reduced the differences in spending across districts. By the early 1980s, the state had gained direct control of 90 percent of school district revenue. Benefitting from the court rulings in Serrano, low-wealth districts received the largest increases in state aid. A district with assessed value per pupil of $5,351, the 25th percentile in 1969-70, would have received $378 per pupil under the old formula and $645 per pupil under the new formula, an increase of $267. In comparison, total revenue per pupil in the 25th percentile was $645 per pupil. Districts with high assessed value received very small increases. A district with assessed value per pupil of $28,375, the 95th percentile in 1969-70, would have received basic aid of $125 per pupil under the old formula and $133 per pupil under the new formula, an increase of $8 (Downes, 1992).

Before proposition 13, state aid was determined by a formula, and the revenue limit determined a district's property tax revenue. However, that limit could be overridden by voters in a referendum. After the proposition, the district's property tax revenue was determined by formula, and the revenue limit determined state aid. Proposition 13 also eliminated voter overrides. A district's revenue no longer depended on the decisions its voters made about their tax rate. Instead, the state legislature determined each district's revenue limit as well as its revenues.

2.2   Michigan

The Michigan school finance program was not a response to any adverse court ruling or to a sudden rise in public concern over inequalities.[3] [4] Rather, it was a by-product of the prevailing debate over pervasively-high property taxes, whose main purpose was supporting local schools.

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[3] There were two court cases, Milliken vs. Green in 1973 and East Jackson Public Schools vs. Michigan in 1984, but both had found the existing finance system constitutional.

[4] For more detailed descriptions of the Michigan reform, see Addonizio et al. (1995), Courant et al. (1995) and Courant and Loeb (1997).

In 1994, just before the program, Michigan's property tax burden was the seventh highest in the country and it was 4th among US states in the share of school spending financed locally (61%). In March 1994 Michigan voters overwhelmingly ratified Proposal A, which reduced the reliance of school revenues on property taxes, replacing them primarily by an increase in the sales tax from 4 to 6%.[5] This resulted in a large rise in the state share of K-12 spending, and was followed by efforts to make a significant dent in existing inequalities. [6]

Prior to the reform, Michigan had been using a district power equalizing (DPE) formula, where districts are allocated state funds based on their tax efforts. This was intended to make the system wealth-neutral[7], leaving the choice of millage rates (property tax rates) to the local districts, but supplementing revenues in districts with low property tax base per pupil. However, the equalizing power of DPE the had considerably eroded over the years. As Cullen and Loeb (2004) note, while there was no limit to the amount of tax effort that the state would match through its guaranteed tax base, there was no recapture of excess funds from higher wealth districts. Also, over time, the guaranteed base did not rise as rapidly as property values, so that the share of off-formula districts rose throughout the 1970s and 1980s. In 1994 about one-third of all districts were too rich to be affected.

The new school spending plan, effective from 1994-95, works as follows. First, the 1993-94 level of spending in each district was taken as its base, and came to be called the district's Foundation Allowance (FA). Second, future increases in all districts' FA's were governed entirely by the state legislature - the lowest spending districts were allowed to increase spending

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[5] Michigan ranked after New Hampshire (86%), Illinois (62%) and Vermont (61%) - subsequently, in 1997, both Illinois and Vermont overhauled their school finance programs.

[6] Taxes on homestead property came down from an average of 34 mills to a uniform statewide rate of 6 mills. The tax on non-homestead property was reduced too, but kept at 24 mills. The share of the state in K-12 spending went up quickly, from 31.3% in 1993 to 77.5% in 1997.

[7] The idea behind wealth-neutrality is that high tax wealth in a district should not lead to high revenues except through a higher tax effort. In general, as preference for school spending is a positive function of income, this does not equalize per pupil expenditures across districts, see Feldstein (1975).

at much faster rates than their richer counterparts. In theory, over time this would lead to a substantial narrowing of the revenue gap across districts. Further, all districts, however rich, were held harmless. None suffered any absolute decline in per pupil spending.

Local discretion over spending was largely abolished following Proposal A - future increases in spending were dictated solely by the state.[8] This has interesting implications for the effect of the program on the high-spending districts. In these districts, per pupil spending increased barely at the rate of inflation after the reform and by much less than was the case just prior to the reform. For example, Bloomfield School district (a high spending district) could only increase its nominal spending by about 10% between 1994 and 2001. Since prices went up by about 20% during this period[9], many of these districts suffered a stagnation, if not an actual fall, in their real per pupil spending.

2.3 Vermont

Before 1997, Vermont relied on a traditional foundation formula to determine the state aid a town received. This foundation aid program was established in 1988 to enable each school district to fund a state-defined, minimum quality education, also known as the foundation cost. Towns received state aid equal to the difference between the foundation cost and how much revenue they could raise from local resources at a state-determined property tax rate. The period leading up to 1997 was a period of decline in the state share and an increase in local contributions to maintain adequate education spending. This reliance on local property taxes resulted in unequal education funding and property tax rates. Downes (2003) notes

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[8] For the three years immediately following Proposal A (1995-1997), districts had the option of levying up to three additional mills for operating expenditure. This ended in the 1997-98 school year. A bill was introduced in 2001 calling for a revision to the law that would allow districts to raise up to one mill for school operating costs with voter approval. However, that bill did not pass, due to fears that it might undermine the initial reform itself (Cullen and Loeb, 2004).

[9] The Consumer Price Index for Midwest Urban went up by 21% between 1994 and 2001.

that between 1990 and 1995, districts with high property wealth increased expenditures at an annual rate of 3.8 percent, while districts with low property wealth increased expenditures by only 1.9 percent. This persistent inequity prompted plaintiffs from property-poor towns to challenge the constitutionality of the system in court, leading to Brigham vs. State.

In 1995 a group of plaintiffs which included Amanda Brigham, a student in the Whiting School District, filed suit against the State of Vermont arguing that the existing school finance system deprived students in property-poor school districts of equal educational opportunities and forced taxpayers in these districts to assume a disproportionate burden of the financing of public education. On February 5, 1997, the Vermont Supreme Court ruled in favor of the plaintiffs, concluding that the existing system deprives children of an equal educational opportunity in violation of the Vermont Constitution. Soon after, Vermont lawmakers enacted the Equal Educational Opportunity Act (known as Act 60), which combined a foundation grant program with a power equalization formula that required property tax rates to vary with local wealth.

Act 60 created a system of school financing that combined elements of foundation and power equalization plans. A statewide property tax was established, with revenues from the tax being used to finance a portion of foundation aid. If in a locality property tax revenues generated by levying the statewide rate exceed the amount needed to finance the foundation level of spending, the excess property tax revenues are recaptured by the state.

Under Act 60, localities are allowed to choose spending levels in excess of the foundation level. However, local spending above the foundation level was funded by a sharing pool, which was funded entirely by local property tax revenues. Towns with high property tax values and/or high spending were required to set local property tax rates that generated revenue in excess of spending, and contribute the excess to the sharing pool. Rates were proportional

to local spending, so that a town that raised local spending would also be forced to increase its contribution to the sharing pool. Further, when the voters in a locality choose a nominal property tax rate above the statewide rate, the revenues that will be available for that locality's schools will not be known with certainty until all other localities have made their taxing decisions and the size of the sharing pool is established.

The above financing mechanism created a substantial incentive for wealthy towns to reduce their school spending, and resulted in considerable leveling-down, with several of the wealthiest towns, known in Vermont as gold towns, responding by cutting their spending all the way down to the foundation grant amount to avoid contributing to the sharing pool. Voters in these property-rich towns had little incentive to approve spending above the block grant because the redistribution of local share revenues cost them more in local taxes than the additional spending they approved. Property-rich towns also sought to escape the high cost of additional local spending in other ways. Many towns financed spending above the block grant privately, through local education foundations: nonprofit organizations with the express purpose of raising resources outside the tax base for education. (Gifts to school districts are exempt from recapture.) Downes (2006) noted that foundations in towns with as few as 1,000 residents raised more than $1 million in annual revenue. The Vermont Department of Education reported that in FY03, more than $12.2 million in private donations contributed to school budgets that year.

The school finance reforms under Act 60 were phased in over several years, with the new regime not fully in place until the 2000-2001 academic year. Note also that low wealth towns were not required to maintain local effort; several towns used the Act 60 windfall primarily to reduce nominal property tax rates. As a result, low wealth towns were not necessarily leveled-up.

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3   Literature Review

To be written.

4   Theoretical discussion: Effects of school finance changes on incentives and response of agents (school districts)

Assume there are two public school districts: one low income/ low expenditure district (denoted by low) and one high income/high expenditure district (denoted by $high$). The objective of each district is to maximize net revenue or rent, defined as revenue minus costs. We consider two scenarios: (i) the scenario before the school finance reform was instituted, which we call the pre-program scenario and (ii) scenario after the institution of the school finance reform or the post-program scenario.

The objective function of each school district can be written as: $R^i(e) = p^i N^i(e) - c^i(N, e)$, where $i = \{low, high\}$, p^i denotes per pupil revenue of district i, N^i denotes number of students in public school district i, c^i denotes cost in district i. $N^i(.)$ function is assumed to be increasing and concave in e and c^i function increasing and convex in its arguments. We assume $p^i - c^i_N > 0$, that is net marginal revenue per student is positive.

We assume that each school district gets revenue from two sources in the pre-program scenario: state aid and local revenue.[10] So, $R^{i,pre}(e) = [p^i_s + p^i_l]N^i(e) - c^i(N, e)$, where $i = \{low, high\}$, p^i_s denotes per pupil aid from the state and p^i_l per pupil revenue raised locally in district i. The pre-program scenario is characterized by local discretion and flexibility and school districts have the ability to affect local revenue through their impacts on property values. For example, an increase in effort can plausibly lead to higher public school quality (scores)

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[10] For simplicity, we assume there is no federal aid. In practice, federal aid is usually a small percentage of school district's total revenue and is unaffected by school finance reform. So, this is not a stringent assumption.

which can increase demand for corresponding schools and housing, which can in turn increase property values and local revenue (given the tax rate). In other words, local revenue depends on public school district effort (e) in the pre-program scenario, $p_l^{i'}(e) > 0$.[11]

Before the implementation of the school finance reform, Michigan had a power equalization plan in place under which per pupil state aid for a district was given by: $p_s^i = max(0, \$400 + mills(\$102, 500 - p_{SEV}^i))$, where p_{SEV}^i is state equalized value per pupil in that district and the guaranteed tax base in 1994 (just before the reform) was \$102,500. Thus in the pre-program scenario, state aid also depended on local effort (specifically, tax effort). So, to generalize, we assume, $p_s^i = p_s^i(e)$, where $p_s^{i'}(e) > 0$. Note that, in Michigan, due to the presence of the power equalization system in the pre-reform period, an increase in district effort increasing school scores and property value would not lead to an increase in local tax revenue (given tax rate) unlike in a typical Tiebout situation described above. However it is plausible that an increase in effort improving school quality and attracting households with higher demand for schooling will lead to an increase in the mills rate thereby increasing local revenue. For the sake of generality (so as to capture both the Tiebout-type pre-program system as well as Michigan-type pre-program system with guaranteed tax base and/or matching grants), we assume that both p_s and p_l depend on e.

It follows from the above discussion that net revenue function in the pre-program scenario

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[11] Note that there can be some added complications here. While an increase in effort will likely increase local revenue through increase in property values, it will plausibly increase the number of students which would tend to decrease per pupil local revenue. A third factor is that an increase in number of students might mean higher demand for schooling and hence a higher tax rate being voted for, which in turn would tend to increase local revenue and local revenue per pupil. We have tried alternative formulations that incorporate these factors. The results below continue to hold although the model and computations become considerably more complicated and messy. So, for simplicity, we assume $p_l^{i'}(e) > 0$ here. (Also note that state revenue increases as number of students increases which will in turn increase total revenue per pupil which is incorporated in the present model.)

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can be re-written as:

$$R^{i,pre}(e) = [p_s^i(e) + p_l^i(e)]N^i(e) - c^i(N,e)$$

where $i \in \{low, high\}$. There exists a unique effort e_i^* for each school district $i = \{low, high\}$ that maximizes the corresponding objective function and solves the following first order condition:

$$[p_s^{i'}(e) + p_l^{i'}(e)]N^i(e) + [p_s{}^i(e) + p_L{}^i(e) - c_N]N^i{}_e(e) = c^i{}_e(e), i = \{low, high\}$$

The school finance reform led to a drastic centralization of school finances. After the reform, the state set the per pupil expenditure levels and the districts virtually had no discretion, unlike earlier. So in the above formulation, per pupil revenue (p) no longer depended on effort (e)[12]. Another important feature was that the low income districts basically got a windfall with per pupil revenue increasing at a very high rate. In contrast, the high end districts barely saw their per pupil revenue go up, they essentially saw a freezing up of their per pupil revenue.

The revenue function of the low expenditure districts can now be given by:

$$R^{low,post}(e) = \bar{p}^{low} N^{low}(e) - c^{low}(N,e)$$

where $\bar{p}^{low} >> p^{low*}$ and p^{low*} is equilibrium per pupil expenditure of low expenditure districts before program.

In contrast, the revenue function of the high expenditure districts can now be given by:

$$R^{high,post}(e) = \bar{p}^{high} N^{high}(e) - c^{high}(N,e)$$

where $\bar{p}^{high} \approx p^{high*}$; $\bar{p}^i$, $i \in \{low, high\}$ denotes state determined per pupil expenditure levels after the program and p^{high*} is equilibrium per pupil expenditure of high expenditure districts

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[12] As outlined in section 2, the extent of loss of discretion varied between states. We address this issue below.

before program. High income districts saw their per pupil revenue go up at a very slow rate. For simplicity, we assume here that it remained constant. The equilibrium effort $\tilde{e}_i$ in the post-program situation solves the following first order condition: $(\bar{p}^i - c^i_N(e))N^i_e(e) = c^i_e(e)$, where $i = \{low, high\}$.

Proposition 1 *(i) For low income school districts, equilibrium public school district effort under the school finance program can be either greater or less than the district effort in the pre-program scenario. (ii)For high income school districts, equilibrium public school effort will be lower under the school finance program than in the pre-program scenario.*

The intuition here is as follows. Since, low income districts faced a large increase in per pupil revenue after the school finance reform, they had an incentive to increase effort to attract students so as to increase revenue. But at the same time, they lost their local discretionary power in the sense that increasing effort to improve school district quality would no longer increase local property tax revenue. This had an adverse effect on effort, thus rendering the total effect on school district effort ambiguous.

High expenditure districts, in contast, faced a very different situation. Their per pupil revenue went up by very little and virtually remained the same. Per pupil spending in these districts is increasing at barely the rate of inflation and by much less than was the case just prior to the reform,–so these districts have less of an incentive to exert effort. So the first incentive above was not present for high income districts. In addition, high income districts also lost local control/discretion. Therefore, on net, one would expect the school finance reform to have an adverse effect on effort in high income districts.

The above analysis assumes that there was a complete loss of local discretion after the school finance reform. However, as described in the previous section, while distrcts, in general, lost most of their discretionary power, there was considerable heterogeneity across states in the extents of loss of local discretion. California saw a complete loss of discretion, followed closely

by Michigan. Vermont also saw a loss of discretion, though it was less severe than California and Michigan. In the above formulation, the per pupil revenue function became considerably less elastic after the program. Let it be denoted by $q(e)$ after the program. Then $q'(e) \approx 0$ in California and $\frac{\delta q}{\delta e}|_{CA} < \frac{\delta q}{\delta e}|_{MI} < \frac{\delta q}{\delta e}|_{VT}$, where the subscripts CA, MI and VT denote the corresponding states.

The revenue function of the low expenditure districts after the program can now be given by:

$$R^{low,post}(e) = (\bar{q}^{low} + q^{low}(e))N^{low}(e) - c^{low}(N, e)$$

where $\bar{q}^{low} >> p^{low*}$ and p^{low*} and $(\bar{q}^{low} + \tilde{q}^{low})$ are respectively equilibrium per pupil expenditure of low expenditure districts before and after program. $\bar{q}^i$, $i \in \{low, high\}$ represents that most of the expenditure was determined by the state.

In contrast, the revenue function of the high expenditure districts can now be given by:

$$R^{high,post}(e) = (\bar{q}^{high} + q^{high}(e))N^{high}(e) - c^{high}(N, e)$$

where $\bar{q}^{high} \approx p^{high*}$, and p^{high*} and $(\bar{q}^{low} + \tilde{q}^{low})$ are equilibrium per pupil effort of high expenditure districts before and after program. The equilibrium effort $\tilde{e}_i$ in the post-program situation solves the following first order condition: $q^{i'}(e)N(e) + (\bar{q} + q^i(e) - c^i{}_N(e))N^i_e(e) = c^i_e(e)$, where $i = \{low, high\}$.

Proposition 2 *Starting from the same pre-program equilibrium, high spending districts suffering larger fall in local discretion will show larger decline in post-program effort.// In the post-program equilibrium, equilibrium effort of high spending districts facing greater loss of local discretion will be less than ones facing less loss of discretion.*

The intuition here is that high income districts facing larger falls in discretion realize that a unit increase in effort would lead to even smaller increases in revenue. Therefore they have less of an incentive to exert effort.

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5   Data

The Michigan part of the data used here is described in detail and is taken from Roy (2009). Most of the data used here were obtained from the Michigan Department of Education (henceforth, MDE). The revenue and expenditure figures were taken from the Bulletin 1014's, published annually. The measures used here are general fund revenues and general fund expenditures respectively. The data on ethnic and gender compositions and free lunch eligibility came from the Pupil Headcount Files and the Food and Nutrition Files of the MDE K-12 database. Some of the data on ethnicity and free lunch eligibility for the early years came from the Common Core of Data (CCD) of the National Center for Education Statistics (NCES). The MDE K-12 Database was also the source of the data on student achievement in state tests. The state assessment in Michigan is known as the Michigan Educational Assessment Program, or MEAP in short. Henceforth we will refer to these tests as MEAP tests and we use grade 4 reading and math data.[13] The data used here span the period 1990 to 2001, which straddle 1994, the last year before reform. Henceforth in the paper, we refer to school years by the calendar year of the spring term - e.g., 1990 refers to academic year 1989-90, and so on.

6   Empirical evidence

In the empirical part of the paper, we test the two predictions obtained above from the theoretical framework. First, the theoretical discussion reveals that the low income districts would face very different incentives compared to high income districts. Consequently the expected responses would also be different between these two types of districts. School finance reforms usually have led to two major direct changes, the first being changes in funds/money and the

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[13] The scores (both reading and math) report the percentage of students scoring at or above satisfactory level in the corresponding subject.

second being loss of discretion. Due to the specific design of the school finance programs, the experiences of these two groups of districts were very different in terms of these two factors. Low income districts faced both an influx of money and a loss of discretion and hence it is difficult to extricate the effects of the two factors from their experience. High expenditure districts also faced loss of discretionary power. However, in contrast with the low expenditure districts, they virtually saw a freezing (or a very slow creeping upwards) of per pupil expenditure.

Therefore, we hope to study separately the effects of school finance reforms on low expenditure and high expenditure districts. The effect on low expenditure districts would give the effect of influx of money and loss of discretion and is instructive. The effect on high expenditure districts on the other hand would give the effect of loss of discretion and is instructive since it helps to separate out the effect of loss of discretion from the effect of money. However, it is important to note here that the effect of loss of discretion we find here would be specific to high income districts and is not generalizable to other districts.

Second, the extents of loss of discretion varied markedly across programs. California suffered the largest loss of discretion, followed closely by Michigan and then Vermont. As discussed above, one would expect different responses from the districts in these three states. To investigate this issue, we study and compare the responses of the high expenditure districts in these three states.

We propose to study these issues using school district level data from Michigan, California and Vermont that will span both pre-program and post-program periods. The stategy will be a simple difference-in-differences and we will compare the experiences of these two treatment groups (low expenditure and high expenditure districts) with appropriate control groups in the corresponding states. In the empirical part of the paper, we focus on student achievement and study whether the effect of the reform was different on low and high expenditure districts.

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6.1 Effect on School Spending in Michigan

The results on the effect of Michigan school finance reform on per pupil revenues and expenditures as well as achievement in low and high expenditure districts are obtained from Roy (2009). To examine the effect of Proposal A on school spending in Michigan, Roy (2009) classifies the 524 K-12 districts into 5 equal groups based on the 1993-94 level of per pupil spending (Group 1 consists of the lowest spending 105 districts, Group 2 consists of the next 105 districts, and so on). The lowest spending districts in group 1 were most similar to those in group 4. This is particularly so when Detroit, the largest school district in the state and which falls in group 4, was excluded. Groups 1 and 4 were performing at very similar levels just before the program (40.59 and 40.95 respectively in reading and 60.01 and 59.82 in math respectively), and their percentage of students eligible for free or reduced-price lunch (23.62 and 22.97 respectively) and pupil-teacher ratios (23.00 and 23.88 respectively) were also quite similar. There were some significant differences in racial composition - the percentage of black students was higher in group 4 districts. However, we control for racial composition of students, along with gender composition and free or reduced-price lunch eligibility in the regressions.

To compare the trends in spending in the different groups, pre and post-reform, the following fixed effects (FE) regression is estimated:

$$Y_{sgt} = \alpha + \alpha_s + \beta_0 * t + \sum_{g \in \{1,5\}} \beta_g * (D_g * t) + \gamma_0 * (reform) + \sum_{g \in \{1,5\}} \gamma_g * (D_g * reform)$$

$$+\theta_0 * (reform * t) + \sum_{g \in \{1,5\}} \theta_g * (D_g * reform * t) + \delta * X_{sgt} + \varepsilon_{sgt} \qquad (1)$$

where $g \in \{1, 5\}$, Y_{sgt} is the per pupil revenue or expenditure of district s in group g in year t, α_s is the district fixed effect while X_{sgt} are the time-varying characteristics (controls).[14] D_g's

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[14] Since free lunch data for 1990 and 1991 are either not available, or not reliable because of small and inconsistent values, we have only included enrollment and racial composition in X_{sgt}. Running the regression on a sub-sample when data on all controls are available does not change the qualitative results.

are the dummy variables for the respective groups of districts. Group 4, comprising of districts in the fourth quintile of the spending distribution in 1994 (the upper middle group), is the omitted category. $Reform$ is a binary variable that takes the value of 0 in the pre-reform period (1990-1994) and 1 afterwards (1995-2001). The variable t represents time-trend. The variables $reform$ and $reform*t$ respectively control for post-reform common intercept and trend shifts. The coefficients on the interaction terms $(D_g * reform)$ and $(D_g * reform * t)$ estimate the program effects - γ_g's capture the intercept shifts while θ_g's capture the trend shifts of different groups of districts. However, as mentioned earlier, the reform was staggered over several years and hence the immediate increase in spending was not large. So the estimated intercept effects are very small, and below we focus on trend shifts in the post-program period.

Michigan results reported here are obtained from Roy (2009). We report results from two samples - the first includes all 524 districts, the second excludes Detroit.[15] Table 1 reports effects of the Michigan program on per pupil revenue and expenditure and the results are obtained from estimation of model 1. The first two columns show the results for revenues, the third and fourth columns show the results for expenditures. As can be seen from the table, both per pupil expenditure and revenue grew at a considerably higher rate in the low expenditure districts compared to the high expenditure districts. And, as shown in the table, not only were the coefficients economically different, but they were different statistically too.

So, the evidence points to a substantial program effect on equalization of school finances across the high and low expenditure districts. We next estimate the effects of the Michigan reform on academic performance.

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[15] Detroit is the biggest school district in Michigan, alone accounting for about 10% of all Michigan K-12 students.

6.2 Effect on Academic Performance

Table 2 reports the the effects of the program on fourth grade MEAP reading and math tests (obtained from Roy (2009)). As earlier we show results for two samples - the first includes all 524 districts, the second excludes Detroit. The achievement results mirror those obtained for revenue and expenditure above. The first two columns report results for reading and the next two columns for mathematics. The first column in each set includes all districts while the second column excludes Detroit. Results including all districts show improvements of low expenditure districts in both reading and math after the reform. Exclusion of Detroit leads to slight moderation of the effects, but still there are positive effects in both reading and math, although the effect in math is no longer statistically significant. In contrast, high expenditure districts show deterioration in both reading and math after the reform. Results including all districts show declines in both reading and math, though they are not statistically significant. With exclusion of Detroit, the declines become larger in magnitude and also statistically significant. These findings are consistent with and support the predictions obtained from theory. They suggest that loss of discretion can lead to fall in public school effort and performance.

7   Conclusion

To be written.

8   References

To be written.

9   Appendix A: Proofs of Results

Proof of Proposition 1. (i) First, consider the low income districts. Evaluating their post-program first order condition at e_{low}^*:

$$\frac{\delta R^{low,post}}{\delta e}|e_{low}^* = \frac{\delta R^{low,post}}{\delta e}|e_{low}^* - \frac{\delta R^{low,pre}}{\delta e}|e_{low}^*$$

$$= [\bar{p}^{low} - (p_s^{low}(e_{low}^*) + p_l^{low}(e_{low}^*))]N^{low}{}_e(e_{low}^*) - [p_s^{low\prime}(e_{low}^*) + p_l^{low\prime}(e_{low}^*)]N^{low}(e_{low}^*) \gtrless 0$$

$$as[\bar{p}^{low} - (p_s^{low}(e_{low}^*) + p_L^{low}(e_{low}^*))] >> 0$$

$$\Rightarrow \tilde{e}_{low} \gtrless e_{low}^*$$

(ii) Now, consider the high income districts. Evaluating their post-program first order condition at e_{high}^*:

$$\frac{\delta R^{high,post}}{\delta e}|e_{high}^* = \frac{\delta R^{high,post}}{\delta e}|e_{high}^* - \frac{\delta R^{high,pre}}{\delta e}|e_{high}^*$$

$$= [\bar{p}^{high} - (p_s^{high}(e_{high}^*) + p_l^{low}(e_{high}^*))]N^{high}{}_e(e_{high}^*) - [p_s^{high\prime}(e_{high}^*) + p_l^{high\prime}(e_{high}^*)]N^{high}(e_{high}^*) <$$

0

$$as[\bar{p}^{high} - (p_s^{high}(e_{high}^*) + p_l^{low}(e_{high}^*))] \approx 0$$

$$\Rightarrow \tilde{e}_{high} < e_{high}^* \quad \blacksquare$$

Proof of Proposition 2. Consider two states, A and B, the only difference between them being the difference in the elasticities with respect to effort in the post-program period. Assume state A faced greater loss of local discretion than state B, that is, $\frac{\delta q}{\delta e}|_A < \frac{\delta q}{\delta e}|_B$. Since this proposition deals only with the experience of high expenditure districts, we have dropped the superscript $i = high$. Instead, the functions are indexed by A or B respectively to denote the corresponding state.

First order conditions of states A and B in the post-program period are given by:

$$\frac{\delta R^{A,post}}{\delta e}| = q'_A(e)N(e) + (\bar{q} + q_A(e) - c_N(e))N_e(e) - c_e(e) = 0$$

$$\frac{\delta R^{B,post}}{\delta e}| = q'_B(e)N(e) + (\bar{q} + q_B(e) - c_N(e))N_e(e) - c_e(e) = 0$$

Assume $\tilde{e_A}$ and $\tilde{e_B}$ solves the first order conditions and assume $(\bar{q} + \tilde{q_A})$ and $(\bar{q} + \tilde{q_B})$ are the corresponding per pupil revenue after program. Then evaluating state B's first order condition at A's post-program equilibrium effort $\tilde{e_A}$:

$$\frac{\delta R^{B,post}}{\delta e}|_{\tilde{e_A}} = \frac{\delta R^{B,post}}{\delta e}|_{\tilde{e_A}} - \frac{\delta R^{A,post}}{\delta e}|_{\tilde{e_A}}$$

$$= [q_B{}'(e_A) - q'_A(e_A)]N(e_A) + [q_B(e_A) - q_A(e_A)]N_e(e) > 0$$

$$\Rightarrow \tilde{e_B} > \tilde{e_A} \quad \blacksquare$$

Table 1: Effect of Michigan School Finance Reform on Per Pupil Revenues and Expenditures

	Per Pupil Revenue		Per Pupil Expenditure	
	(1)	(2)	(1)	(2)
Group 1 * reform * t	146**	162**	111**	83**
	(28.51)	(20.78)	(40.82)	(20.59)
Group 5 * reform * t	-105**	-87**	-24	-53*
	(33.43)	(27.66)	(43.75)	(26.69)
Observations	6269	6257	6269	6257
R-squared	0.96	0.96	0.96	0.96
[1]P-values of equality of group 1 and group 3 effects	0.00	0.00	0.00	0.00

Group 4 is the omitted category. Columns marked (1) include all 524 school districts, while columns marked (2) exclude Detroit, which is the largest district in the state (accounting for about 10% of the total number of students in the state). All regressions are weighted by district enrollment, include district fixed effects, and control for enrollment and ethnicity. Revenue relates to general fund revenues and expenditure to general fund expenditures. [1] denotes p-value corresponding to F-test that program effects on group 1 equal effects on group 5. [+], [*], [**] denote significance at the 10, 5, and 1 percent levels respectively.

Table 2: Effect of Michigan School Finance Reform on Grade 4 Reading and Mathematics Tests

	Reading		Mathematics	
	(1)	(2)	(1)	(2)
Group 1 * reform * t	2.97**	1.15$^+$	1.77$^+$	1.10
	(1.14)	(0.68)	(1.14)	(0.84)
Group 5 * reform * t	-0.70	-2.48**	-1.32	-1.94*
	(1.20)	(0.78)	(1.16)	(0.87)
Observations	4678	4671	4678	4671
R-squared	0.83	0.84	0.85	0.86
P-values of equality of group 1 and group 3 effects	0.00	0.00	0.00	0.00

Group 4 is the omitted category. Columns marked (1) include all 524 school districts, while columns marked (2) exclude Detroit, which is the largest district in the state (accounting for about 10% of the total number of students in the state). All regressions are weighted by district enrollment, include district fixed effects, and control for enrollment and ethnicity. [1] denotes p-value corresponding to F-test that program effects on group 1 equal effects on group 5. $^+$, *, ** denote significance at the 10, 5, and 1 percent levels respectively.