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Abstract

In 1994, Michigan enacted a comprehensive school finance reform that not only significantly increased state aid to low-spending districts, but also placed restraints on the growth of spending in high-spending districts. While a rich literature studies the impact of school finance reforms on resource equalization, test scores, and residential sorting, there is no literature yet on the impact of such reforms on resource allocation by school districts. This study begins to fill this gap. The Michigan reform affords us a unique opportunity to study the impacts of such reforms on resource allocation in districts located at different points of the pre-reform spending distribution, and we study this both theoretically and empirically. We find that the reform led the high-spending districts to allocate a lower share of their total expenditure to support services and a higher share to instruction (relative to the low-spending districts). To the extent that instructional expenditures are more productive and contribute to student achievement more than support services expenditures, these results suggest that the reform led to a relative increase in productivity in the high-spending districts. This finding is robust in that it continues to hold in each of the seven years after the reform we analyze, is not sensitive to alternative specifications and controls, and survives a series of sensitivity tests. This finding has important policy implications, and this evidence of resource reallocation by districts facing school finance reforms should be taken into account in the design of any school finance policy.

Key words: tiebout, incentives, resource allocation, school finance

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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 United States. A substantial share of the total funds for educational expenditures is raised at the local school district level, primarily by taxes levied on property. This reliance on local tax revenues leads to a Tiebout-type sorting across school districts, and creation of high spending and low spending communities, with spending highly correlated with school district wealth. A school finance reform, loosely interpreted as an equalization of school finances within state boundaries, is aimed at weakening the nexus between school district wealth and per pupil spending. Such measures, which have over the years become an important element in the K-12 educational system of the country[1], typically achieve this by large increases in state aid to poorer districts, often coupled with restrictions on spending in the richer ones. In this paper we study a hitherto-neglected aspect of school finance reforms – in particular, we investigate how these reforms affect the allocation of expenditures in various spending categories in school districts located at different points of the spending distribution.

We focus on the Michigan school finance reform – one of the most important and comprehensive reforms in the nation. In 1994, Michigan radically altered its school financing rules, and the Michigan school finance reform, known as Proposal A, was enacted. Proposal A did not follow from any court ruling, making it one of the more unique school finance reforms. The school finance reform in Michigan was instrumental in significantly increasing the growth rates of spending in the lowest-spending districts, and in reducing spending gaps between the high spending and low spending districts (Cullen and Loeb (2004), Papke (2005), Roy (2011)).[2]

In this paper we go behind the black box to investigate whether (and how) the Michigan school finance reform affected resource allocation between alternative spending categories. We also distinguish between impacts on school districts located at different points of the pre-reform spending distribution, as these districts were affected differently by the reform and hence faced different incentives in the post-

[1] Hoxby (2001) argues, unlike most other reforms, school finance equalization has affected almost every school in the nation – some of them dramatically.

[2] In this study, we use the words expenditure and spending interchangeably.

reform period. We start with a simple theoretical framework that captures the basic features of the Michigan system – the objective is to understand the incentives created by the Michigan school finance reform for districts located at different points of the pre-reform spending distribution, and the potential responses of these districts. Our model reveals that such a reform might affect district's incentives and responses through multiple channels, not all of which work in the same direction. Thus the actual impact is more of an empirical question that we address empirically in the paper next.

We use detailed data on disaggregated spending to analyze whether and how incentives created by the school finance reform actually mattered. We distinguish between two types of expenditures: (i) instructional expenditure that is thought to be closely related to student learning and development, and hence regarded as productive, and (ii) support services expenditure (including operation and maintenance expenditure, business support expenditure, school administration support expenditure etc.) which is thought to be less so. We find robust evidence that the Michigan school finance reform led districts to reallocate their resources between alternative spending categories. Specifically, we find that in the post-reform period the high spending districts allocated a lower share of their total expenditure to support services and a higher share to instruction (relative to the low spending districts). This finding is robust in that it continues to hold in each of the seven years after the reform we analyze, is not sensitive to alternative specifications and controls, and survives a series of sensitivity tests. It suggests that the reform led to a relative increase in productivity or efficiency in the high spending districts (as captured by a relative substitution away from support services categories and towards instructional categories). While the slower growth rate of spending in the high spending districts following the reform may have acted as a disincentive to increase effort or productivity, there were other factors at play too (as is evident in the theoretical discussion (section 3)). Threat of loss of students (and hence revenue) with a decrease in effort coupled with a decrease in school spending (both of which are valued by households) may have induced the high spending districts to re-allocate resources away from less productive and towards more productive categories in an effort to attract (or retain) their potential customers.

This study is most closely related to two strands of literature in public finance and economics

of education – one that deals with the effects of school finance reforms, and one that looks at the effects of previous tax and expenditure limitations. The empirical studies on school finance reforms generally find that these reforms – particularly those mandated by the courts – have had a large positive effect on equalization of school resources (Murray, Evans, and Schwab (1998), Card and Payne (2002), Cullen and Loeb (2004), Corcoran and Evans (2007)). There is also some evidence of positive effects on student performance in districts which witnessed large increases in spending and among family background groups which were initially lagging behind (Card and Payne (2002), Papke (2005), Roy (2011)). Chaudhary (2009) finds that Proposal A led to positive effects on fourth grade math test scores, but she finds no statistically significant effect on seventh grade scores. Ferreyra (2009), using a general equilibrium framework and focusing on the Detroit metropolitan area, does not find any effect of Proposal A on school quality. Chakrabarti and Roy (2015) find that Proposal A led to a decline in neighborhood sorting, as measured by changes in the value of housing stock and socioeconomic indicators. However, none of these studies – either for Michigan or any other state – focuses on changes in resource allocation. In particular, there is no literature that analyzes spending priorities of districts in the aftermath of such programs and relates them to changes in the nature of the incentives faced by districts located at different points of the pre-reform spending distribution. This study sheds light on this important, but so-far neglected issue.

This study is also related to the literature that analyzes the effects of broader tax and spending limits. Figlio (1997) uses detailed school-level data from 49 states to analyze the effects of tax-revolt era property tax limitations – defined as limitations passed during the "local property tax revolt" of the late 1970s and early 1980s – on school services. He finds that these limitations were associated with larger student-teacher ratios, lower starting salaries for teachers, and lower student performance. Dye and Mcguire (1997) analyze the effect of a property tax cap enacted in a subsample of Illinois districts in 1991. Their results suggest that the cap had a restraining effect on school district operating expenditures, but no effect on school district instructional spending. Figlio (1998) studies the effect of Oregon's Measure 5, a tax limitation imposed in 1990. He finds that the incidence of Measure 5 was

borne by instructional expenditures at least as much as by administrative expenditures.

The present study differs from earlier studies in some fundamental ways. First, the questions posed here are different. We are interested in analyzing how school finance reforms affect incentives and resource allocation of districts at different points of the spending distribution. Second, while some of the previous literature on tax and expenditure limitations concerned property taxes and hence had bearing on school expenditures, it is arguable that a school finance reform will have a more direct impact on allocation of educational spending and outcomes than a general tax limitation policy. Third, only a few studies make the link between revenue limitations, district incentives, and spending allocation. Specifically, no previous study on school finance reform has studied this link. In Michigan, prior literature has documented the stark impacts of the reform on school district revenues in the post-Proposal A period – the markedly slower growth rate of revenue in high spending districts and an impressive increase in growth rate of revenue in the low spending districts (Cullen and Loeb, 2004; Roy, 2011). We analyze whether these different revenue impacts translated into different incentives and hence spending priorities in the post-reform period. To the best of our knowledge, the findings of this paper are novel in the literature and have important policy implications. They highlight the fact that school finance reforms affect school district incentives and responses (as captured by resource allocations), which in turn differ markedly between districts located at different points in the spending distribution. Policy makers need to understand and take into account these responses for an adequate school finance policy design or changes in school finance policies.

2 Michigan School Finance Reform

Unlike most comprehensive school finance reforms, the Michigan program was not a response to any adverse court ruling or to a sudden rise in public concern over inequalities.[3] It was rather a consequence of the prevailing debate over high property taxes, whose main purpose was supporting local schools. In 1994, just before the reform, Michigan's property tax burden was the seventh highest in the country, and

[3] Two court cases in the previous two decades, Milliken vs. Green in 1973 and East Jackson Public Schools vs. Michigan in 1984, had both found the existing finance system constitutional. For more detailed descriptions of the Michigan reform, see Addonizio, Kearney, and Prince (1995), Courant, Gramlich, and Loeb (1995), and Courant and Loeb (1997).

Michigan was fourth among U.S. states in the share of school spending financed locally (61 percent).[4] 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 percent. This change led to a more than doubling of the state share of K-12 spending, and state aid was used to equalize per pupil spending across districts.[5]

At the time of the reform, Michigan's state aid was based on a district power-equalizing (DPE) formula, whereby districts were allocated state funds based on their tax efforts. The objective was to make the system wealth-neutral,[6] leaving the choice of millage rates (property tax rates) to the local districts but supplementing revenues in districts with a low property tax base per pupil. However, the equalizing power of DPE had considerably eroded over the years. As Cullen and Loeb (2004) note, there was no limit to the amount of tax effort that the state would match through its guaranteed tax base. The state also did not recapture excess funds from wealthy districts. In addition, 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 1994-1995 school year, worked 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. Second, future increases in all districts' foundation allowances were governed entirely by the state legislature. The lowest-spending districts were allowed to increase spending at much faster rates than their richer counterparts so that the spending gap across districts could be progressively closed. Furthermore, all districts, however rich, were held harmless with no absolute decline in per pupil spending in any district. Thus, on the one hand, the low spending districts saw a marked increase in their spending growth rate, while on the other, the more wealthy districts saw a

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

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

[6] 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. However, preferences for school spending are generally increasing in income and educational attainment, and the wealth-neutrality principle per se does not equalize per pupil expenditures across districts (see Feldstein 1975).

perceptible decline in their spending growth rate.[7]

Local discretion over spending was largely abolished following Proposal A[8]; future increases in spending were dictated solely by the state. This change had important implications for the effect of the reform on the high-spending districts. In these districts, per pupil spending barely kept pace with inflation after the reform and rose by much less than had been the case just before the reform. For example, Bloomfield School District (a high-spending district) could increase its nominal spending by only about 10 percent between 1994 and 2001. Since prices went up more than 20 percent during this period, many of these districts suffered a stagnation, if not an actual fall, in their real per pupil spending.

3 Theoretical Framework

In this section, we start by constructing a simple model that captures the basic features of the Michigan school finance system that prevailed in pre-reform Michigan. The objective of the theoretical framework is to understand, in a simple framework, the impacts of the Michigan school finance reform on public school incentives and responses. Moreover, should we expect the school finance reform to have different impacts in high spending and low spending districts?

In keeping with the literature (Manski (1992), Hoxby (2003a), McMillan (2004), Ferreyra and Liang (2012), Chakrabarti (2013)), the objective of the public school district is to maximize net revenue (rent) which is simply defined as revenue minus costs. School district revenue is given by $p.N$, where p is per pupil revenue and N is the number of students in the public school district. School district cost (C_D) is given by $C_D(N, e) = c_1 + c(N) + C(e)$, where c_1 is a fixed cost and e is school district effort. Both $c(.)$ and $C(.)$ functions are assumed to be increasing and strictly convex in their respective arguments.

The number of students a school district can attract depends on its spending (E) and its effort (e).

[7] The increases in spending for the low-spending districts leveled off after 2003 – note that this was after the end of our sample period (1990-2001).

[8] In principle, districts could spend less than the amount prescribed for them by the state – however, the state had put in place significant incentives to ensure that districts in reality taxed themselves appropriately and spent at the mandated level. For example, districts were required to levy 18 mills on non-homestead property for full participation in the state school finance program – otherwise they lost a significant amount of state aid, see Cullen and Loeb (2004).

For simplicity, we assume that households observe and care for both district spending and effort (Manski (1992), Hoxby (2003), Ferreyra (2007), Chakrabarti (2013)).[9] The net revenue (R) function of the public school district is represented by $R = p.N(E, e) - [c_1 + c(N(E, e)) + C(e)]$, where N is continuous, twice differentiable, additively separable, increasing, and concave function of its arguments.[10]

Under the assumption of "balanced budget" (that is equality of revenue and expenditure), $E = S + F + L$, where S, F, L respectively denote state aid, federal aid, and local revenue. State aid is represented by $s.N$ where s is per pupil state aid. We assume that s is exogenously given to the school district based on the state aid formula and the demographic characteristics of the district. Since state aid per pupil is less than per pupil revenue, there exists an $\alpha > 0$ such that $s = p - \alpha$. It is worth noting here that while we assume here that s is exogenously given to the school district (to simplify computations), all results continue to hold if we assume that s depends on school district effort e – these results are not reported for lack of space, but are available on request.[11] Federal aid F is given to the district based on the federal allocation formula and the school district's demographics.

Local revenue raised by the district is represented by $V(e)$, where V is an increasing and strictly concave function of e.[12,13] In other words, the school districts have local discretion and have the ability to positively affect local revenue through effort.

[9] To simplify computations, we assume here that number of students depend on spending; note that all results continue to hold if we instead assume it depends on per pupil spending.

[10] Additive separability of the N function in E and e simplifies computations greatly, but all results continue to hold without this assumption.

[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: $s = max(0, \$400 + t.(\$102500 - SEV_{pp}))$, where SEV_{pp} is state equalized value per pupil in that district, t is the property tax rate, 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, local tax effort). The assumption of exogeneity of s here is made to simplify computations, and also to be more general. A pre-reform scenario is typically (that is, in most other states) characterized by a scenario where s is given (exogenously) to the district.

[12] It is worth pointing out here that in Michigan, due to the presence of the power equalization system in the immediate pre-reform period, an increase in district effort increasing school scores and property value would not directly lead to an increase in total revenue (given tax rate) unlike in a typical Tiebout situation. However, an increase in tax effort or an increase in district effort improving school quality can attract households with higher demand for schooling who, in turn, can vote for a higher property tax rate leading to an increase in both local and total revenue. Thus, an increase in school district effort can still increase local and total revenue in pre-reform Michigan, but through a slightly different mechanism. For the sake of generality (so as to capture both the Tiebout-type system as well as Michigan-type pre-program system with guaranteed tax base and/or matching grants), we assume that local revenue depended on e, $L = V(e), V_e > 0, V_{ee} < 0$.

[13] While we make assumptions of strict concavity or convexity for the various functions (as outlined above), all our results go through if at least one of these functions satisfies the strictness assumption.

Following from the above discussion, $E = (p-\alpha).N(e,E)+F+V(e) \Rightarrow E = E(p,e,V(e),\alpha,F)$. (3.1)
Note that we explicitly write E as a function of $V(e)$ instead of $E = E(p,e,\alpha,F)$ to highlight the difference in the role of local discretion of school districts before and after the reform; all results continue to hold if we use the simpler formulation $E = E(p,e,\alpha,F)$. It follows from (3.1) and the discussion above that the net revenue function can be written as: $R = p.N\big[E(p,e,V(e),.),e\big] - \Big[c_1 + c\Big[N[E(p,e,V(e),.),e]\Big] + C(e)\Big]$. The school district chooses effort to maximize net revenue. There exists a unique effort e^* such that it solves the first order condition:

$$\frac{\delta R(e,.)}{\delta e} = (p - c_N)[N_E(E_e + E_V.V_e) + N_e] - C_e(e) = 0 \qquad (3.2)$$

Under strict concavity and convexity of the $N(.)$ and $C(.)$ functions respectively, the net revenue function is strictly concave and the second order condition is satisfied. Also, note that it follows from the first order condition (3.2) that $p - c_N > 0$.

The Michigan school finance reform led to a drastic centralization of school finances, whereby the state set the per pupil expenditure of each district, and the districts virtually lost discretion over local revenue. A key feature of the reform was that the low spending districts saw a marked increase in their per pupil revenue which increased at a higher rate (during the period under consideration here). In contrast, while the high spending districts did not see a decline in their per pupil revenue as they were "held harmless", they saw a marked decline in the rate of growth of per pupil revenue, and their per pupil revenue often grew at a rate lower than the rate of inflation (see discussion in the last paragraph of section 2). For simplicity and to avoid messy computations, we approximate this in our model by assuming that the high spending districts faced a decline in per pupil revenue (p) and the low spending districts faced an increase in p. Using comparative statics, we next investigate the impact of a change in p on school district effort e to understand the incentives faced by the low spending and high spending districts after the reform. An increase in school district effort implies an increase in productivity or efficiency of a district, and vice versa. Such an increase (or decrease) in efficiency should be reflected in the district's decision to allocate its spending between instructional and non-instructional (or support spending). For example, we might expect an increase (decrease) in efficiency to lead a school district to

allocate a higher (lower) share of its spending to instructional expenditure which is regarded as more productive and lower (higher) share to non-instruction or support spending.

Proposition 1 *An increase in p can lead to an increase or decrease in equilibrium effort, and vice versa.*

The proof of Proposition 1 is in Appendix A. As can be seen from A.1 (in Appendix A), equilibrium effort increases (decreases) with an increase (decrease) in p if and only if

$$N_E[E_e + E_V V_e] + N_e + (p - c_N)N_{EE}E_p(E_e + E_V V_e) - c_{NN}[N_E E_p[N_E(E_e + E_V V_e) + N_e]] > 0 \quad (3.3)$$

However, as can be seen, the first two terms are positive and the second two terms are negative (as $N_{EE} < 0$ and $c_{NN} > 0$), making the sign of the expression in (3.3) ambiguous.

Let's consider the incentives of a school district facing an increase in p. An increase in effort leads to an increase in N both directly (reflected in the second term in (3.3)) as well as through an increase in spending (reflected in the first term in (3.3)), thus leading to an increase in revenue of the school district. Thus the first two terms induce a district facing an increase in p to respond by increasing e. However, an increase in spending (both through *a direct increase in* p as well as through e) leads to an increase in N (and hence revenue) at a decreasing rate (*that is, marginal revenue declines*) as captured by the third term in (3.3). This has a negative impact on e. Moreover an increase in spending (both through *a direct increase in* p as well as through e) increasing N leads to an increase in cost at an increasing rate (*that is, marginal cost increases*) as captured in the last term in (3.3). These negatively affect incentives to increase e. Because of these opposing channels, it is not clear whether a school district facing an increase in p will increase effort. The role of local discretion is worth discussing further. In the pre-reform period, an increase in e leads to an increase in property tax revenue (as captured by $E_v.V_e$ in the first term) thus attracting more students and revenue, and consequently inducing the school district to increase effort. The absence of this channel in the post-reform era has a negative impact on effort. However, in the pre-reform period, an increase in spending brought about by the increase in local revenue increases students (and revenue) at a decreasing rate and cost at an increasing rate (third

and fourth terms in (3.3) respectively), thus discouraging an increase in effort. This force is absent in the post-reform period.

Next, let's consider the incentives of a district facing a decrease in p. The first two terms in (3.3) would dictate a decrease in effort. However a decrease in p (directly operating through a decrease in spending) and a decrease in effort (both directly and through a decrease in spending) decrease N (and hence revenue) at an increasing rate, as can be seen from the third term in (3.3) as $N_{EE} < 0$. Moreover, a decrease in p directly operating through spending and a decrease in e (both directly and through spending) decrease N leading to a decrease in cost at a decreasing rate (as follows from the fourth term in (3.3)). These last two channels (implying an increase in marginal revenue and a decline in marginal cost) have a positive effect on e. Of note here is that an increase in e in turn increases N (and hence revenue) both directly and through an increase in spending. Local discretion also has opposing effects (the first two terms versus the last two terms). Thus, once again due to the presence of counteracting effects it is not clear whether a decrease in p would lead to a decrease or increase in school district effort.

To summarize, the simple theoretical discussion above reveals that a school finance reform affects incentives in high spending and low spending districts quite differently. Moreover, there are a number of mechanisms involved not all of which work in the same direction, and hence the direction of the ultimate effect on school district effort is not clear, both in low spending and high spending districts. Rather, this is more of an empirical question that we address empirically in the sections that follow. Specifically, we study the impact of the school finance reform on the allocation of resources in various spending categories both in low spending and high spending districts. Since instructional spending is regarded as the more productive part of spending and non-instructional (or support spending) as the less productive part (U.S. Department of Education (2009), Weber and Ehrenberg (2009), Welsch (2011), Chakrabarti and Sutherland(2013)), an increase in the share of instructional spending and/or a decrease in the share of support spending in the post-reform period is taken here as indicative of an increase in productivity or efficiency of the district.

4 Data

We use data from multiple sources in the analysis that follows. Most of the data come from the Michigan Department of Education (henceforth, MDE) and the School District Finance Survey (F-33) of the National Center for Education Statistics' Common Core of Data. The total revenue and expenditure figures and the disaggregated data on different spending categories are obtained from NCES's School District Finance Survey. Since the Michigan reform only affected current expenditures (while capital expenditures were unaffected), we focus our analysis in this paper on components of current expenditure. The top panel of Figure 1 presents the components of total expenditure and their shares in the pre-reform period – current expenditure commanded, by far, the largest share, constituting 86.4% of total expenditure.[14]

The bottom panel of Figure 1 presents the components and shares of total current expenditure in the pre-reform period. Instructional expenditure constituted 59%, support services expenditure 35%, and other elementary-secondary education expenditure 6% of total current expenditure. As percentages of total expenditure (Table 1), the shares for instructional, support services, and other elementary-secondary expenditures were respectively 50%, 32%, and 4% in the pre-reform period. Instructional expenditure includes teacher (and teacher aide/assistants) salaries and benefits, and classroom supplies; support services include spending on non-instruction and support services (see components below); other elementary-secondary current expenditure includes food services, enterprise operations, and other elementary-secondary current expenditure.

Support services expenditure includes pupil support services expenditure, instructional staff support expenditure, general administration expenditure, school administration expenditure, operation and maintenance expenditure, business support expenditure, pupil transportation expenditure, and nonspecified support services expenditure. For lack of space, we focus on the first six categories in this study. The shares of these categories in the pre-reform period as a percentage of total expenditure are presented in Table 1 – operation and maintenance was the largest category followed by school

[14] Other categories were non elementary-secondary expenditure, capital expenditure, interest on debt, and payments to other school systems; other than capital expenditure, these categories were very small.

administration support and then pupil support services. Pupil support services include attendance record keeping, student accounting, social work, counseling, student appraisal, record maintenance, and placement services; instructional staff support includes expenditures for supervision and instruction service improvements, curriculum development, instructional staff training, and instructional support services such as library; general administration includes expenditure for board of education and executive administration (office of the superintendent) services; school administration includes expenditure for the office of the principal services; business support includes payments for fiscal services, purchasing, warehousing, supply distribution, publishing, and duplicating services.

The data on ethnic and gender compositions come from the Pupil Headcount Files and the Food and Nutrition Files of the MDE K-12 database.[15] We use enrollment data from F33 to generate per pupil expenditure figures for the various spending categories above.

The data used in this study span the period 1990-2001, which straddle 1994, the last year before reform.[16] This time span allows us to capture differences in pre-reform trends across districts and also to capture program effects that may occur only with a lag.

In addition, we use data from the 1980 decennial census and the 2000 decennial census, both obtained from the Census Bureau, to look at the changes in private school enrollment across Michigan school districts during this decade.

For our analysis involving private school entry, we rely on the data on private schools collected by the National Center for Education Statistics (NCES) of the U.S. Department of Education. The NCES administers the Private School Survey (PSS) every other year, which collects information on every private school in the nation. We obtained private school location data from the PSS for the years 1990-2000.

[15] Some of the data on ethnicity for the early years come from the Common Core of Data of the National Center for Education Statistics.

[16] Henceforth in the paper, we refer to school years by the calendar year of the spring term; for example, 1990 refers to academic year 1989-90, and so on.

5 Empirical Analysis: Investigating the Impact of the Reform on Resource Allocation

In this section, we proxy productivity (or efficiency) using spending indicators employed previously in the literature. Spending on administration has often been seen as a measure of rent-seeking activities in the literature, while spending on instruction is considered productive and more beneficial to students. For example, a recent communiquè from the U.S. Department of Education (2009) explicitly asked school districts to invest Title I dollars in improving instruction, so as to bolster student achievement (Fuller et al., 2011). A study by Webber and Ehrenberg (2009) examining patterns of spending in higher education find that instruction has statistically significant positive impacts on college graduation rates unlike other expenditure categories. Welsch (2011) examined the effect of charter school competition in Michigan on the percentage of total general fund expenditures allocated toward instructors, administrators, and support personnel in public school districts. He found that competition from charter schools resulted in a higher percentage of expenditures on instructors and smaller percentage expenditures on employees who support instructors.

We investigate the effect of the Michigan school finance reform on resource allocation using detailed data on revenue allocation obtained from the F33 database. As outlined in section 4, it includes data on different expenditure categories such as instructional expenditure and different forms of support expenditures such as pupil support services expenditure, instructional staff support expenditure, general administration support expenditure, school administration support expenditure, operation and maintenance expenditure, and business support expenditure. Resources allocated to these categories after the reform and especially the shares (percentage contributions) of these categories give us a sense of how the school districts responded in the aftermath of Proposal A. In Michigan, there is some evidence that school districts impacted by other reforms did indeed change their allocation of resources. Specifically, as discussed above, Welsch (2011) finds that school districts threatened by competition from charter schools increased the share of instructional expenditures.[17] This indicates that school districts do re-

[17] In fact, according to Michigan Law, district administrators have discretion over their employment mix. The Michigan (Revised) school code, section 380.11a, notes that: (3) A general powers school district has all of the rights, powers,

spond when facing incentives. Therefore, if the school finance reform did indeed affect their incentives to be productive, one would expect to see corresponding responses from the school districts in terms of changes in resource allocation.

To examine the effect of Proposal A on allocation of school spending in Michigan, we first classify the 524 K-12 districts into five equal groups (quintiles) based on the distribution of 1993-94 level of per pupil spending.[18] The districts in the lowest-spending group – Group 1 – saw their revenues and expenditures increase at very rapid rates over the next several years. On the other hand, districts in the highest-spending group (Group 5) saw their revenues increase at a very low rate, often below the rate of inflation.

Summary statistics on these groups of districts are presented in Table 1. For districts in the Upper Middle Group, we further show the statistics when we leave out Detroit, the most populous school district in the state. As expected, districts in the lowest spending groups had lower expenditure per pupil, though the differences across Groups 1, 2, and 3 were not that big. In contrast, the expenditures in the lowest three groups were markedly lower than in groups 4 and 5. The top panel of Figure 1 presents the composition of total expenditure in the pre-reform period – current expenditure, by far, constituted the largest share of total expenditure (86%).

Since the Michigan school finance reform tenets related only to current expenditure, we study the impact of the reform on allocation of resources in the various current expenditure categories. The bottom panel of Figure 2 shows that current expenditure had three components – instructional expenditure, support services expenditure, and other elementary-secondary expenditure, the former two constituting about 94% of current expenditures. Table 1 shows the shares of these three categories as a percentage of total expenditure. (Note that we should not expect the shares of these categories for each group to sum to 100 in Table 1 as they are expressed as percentages of total expenditure, not current expenditures (unlike bottom panel of Figure 1).) We also present the shares of various components of support services

and duties expressly stated in this act; ...including, but not limited to, all of the following:...(d) Hiring, contracting for, scheduling, supervising, or terminating employees, independent contractors, and others to carry out school district powers.

[18] This classification follows Roy (2011) and Chakrabarti and Roy (2015). Cullen and Loeb (2004) too have a similar classification in terms of quintiles of pre-reform spending distribution. There are an additional 31 non-K-12 districts in Michigan; however, most of these are very small.

(as a percentage of total expenditure) in the table. As can be seen, for each of these categories, the pre-reform shares were similar across the different groups of districts (much more similar than the differences in per pupil expenditures in the top part of the table).

There were some differences across the groups of districts in terms of student demographics. Districts in Groups 1, 2, 3 and 5 were overwhelmingly white, while districts in Group 4 were less so. Group 4 had a significant share of black students unlike the other groups. The proportion of Hispanic students in each of the groups was low.

Using pre-reform data, Table 2 investigates whether there were differences in pre-existing trends between the different groups in per pupil revenue before Proposal A. We run the following fixed-effects regression using pre-reform data:

$$Y_{sgt} = \alpha_0 + \sum_{g \in \{1,...,5\}} \alpha_{1g} * (D_g * t) + \alpha_2 * X_{sgt} + \alpha_s + \varepsilon_{sgt} \qquad (1)$$

where $g \in \{1, ..., 5\}$, Y_{sgt} is the per pupil revenue of district s in group g in year t, t denotes time trend, α_s is the district fixed effect, and X_{sgt} are the time-varying characteristics (controls). D_gs are the dummy variables for the respective groups of districts.

Throughout this study, we report results from two samples: the first includes all 524 districts, and the second excludes Detroit.[19] Table 2 shows that there was a significant hierarchy in revenue trends before the reform. Pre-reform trends in revenues were the highest in Group 5 districts, followed by districts in Group 4 and so on. Conversely, districts in Group 1 were lagging behind all other districts. These data show that existing inequalities had been widening in the years just before the reform.

Having documented the pre-reform setting, we next turn to investigating the effect of Proposal A. First we estimate the following regression to estimate the effect of the reform on per pupil revenue in the various groups of districts:

$$Y_{sgt} = \beta_0 + \sum_{g \in \{1,...,5\}} \beta_{1g} * (D_g * t) + \sum_{g \in \{1,...,5\}} \beta_{2g} * (D_g * reform)$$
$$+ \sum_{g \in \{1,...,5\}} \beta_{3g} * (D_g * reform * t) + \beta_4 * X_{sgt} + \alpha_s + \varepsilon_{sgt} \qquad (2)$$

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

Here $reform$ is a binary variable that takes the value of 0 in the pre-reform period (1990-94) and 1 afterward (1995-2001). The variable t represents time trend – it takes a value of 0 in the year immediately preceding the reform (1994) and increases in increments of 1 for each subsequent year and decrements by 1 for each previous year. The interaction term $(D_g * t)$ allows for differences in pre-reform trends between groups, and allows for estimation of post-reform effects after controlling for these pre-reform trends. X_{sgt} includes enrollment, and racial and gender composition of students. 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: β_{2g} captures the intercept shifts, while β_{3g} captures the trend shifts of different groups of districts.

Next, we study the impact of the reform on allocation of spending in the various component categories discussed above. For this purpose we look at the impact of the reform on both per pupil spending in these component categories as well as on their shares.

$$Y_{ksgt} = \gamma_{0k} + \sum_{g\in\{1,\ldots,5\}} \gamma_{1kg} * (D_g * t) + \sum_{g\in\{1,\ldots,5\}} \gamma_{2kg} * (D_g * reform) + \sum_{g\in\{1,\ldots,5\}} \gamma_{3kg} * (D_g * reform * t) + \gamma_{4k} * X_{sgt} + \alpha_s + \varepsilon_{ksgt} \quad (3)$$

where Y_{ksgt} is per pupil spending (or share) of category k in district s in group g in year t. The coefficients of interest here are γ_{2kg} and γ_{3kg} – these capture intercept or trend shifts of the component shares or per pupil amounts following the reform for the respective groups (relative to corresponding pre-reform trends). These reveal whether the different groups of school districts responded to the incentives created by Proposal A by changing the allocation mix.

We also estimate an alternative specification where we use a single continuous metric ("ratio") which is defined as the ratio of district s spending to mean spending in the pre-reform year (1993-94).

$$Y_{ksgt} = \delta_{0k} + \delta_{1k} * t + \delta_{2k} * (ratio * t) + \delta_{3k} * (reform) + \delta_{4k} * (reform * t) + \delta_{5k}(ratio * reform) + \delta_{6k}(ratio * reform * t) + \delta_{7k} * X_{sgt} + \alpha_s + \varepsilon_{ksgt} \quad (4)$$

The coefficients of interest here are δ_{5k} and δ_{6k}. An advantage of this specification is that it reduces any risk of classification errors for districts that are close to the cut-points of the quintiles. However, a

disadvantage is that this specification assumes linearity of impacts in pre-reform spending unlike (2) and (3) – it assumes that equidistant districts located in different parts of the spending distribution have same incremental effects. However, estimating multiple specifications helps us understand the impacts better and make a better judgment on the robustness of the effects.

6 Results

First, Table 3 analyzes the effect of the Michigan reform on per pupil revenues using specification (2). The first column includes all school districts, while the second excludes Detroit (the largest district in the state). The results obtained in this table mirror those obtained in the previous literature (Papke (2005), Roy (2011), Chakrabarti and Roy (2015)). Table 3 shows that the patterns in post-reform trends were very different from the pre-reform patterns seen in Table 2. In fact, the hierarchy in trends seen in the pre-reform period (Table 2) reversed itself. Controlling for pre-reform trends, post-reform trends in revenue were the highest for Group 1 districts, followed by Group 2 districts, and so on. In other words, the reform led to a convergence in revenue trends between the highest and lowest spending districts in Michigan. Group 1 post-reform trends were not only economically substantially larger than corresponding Group 5 trends, but also statistically different. The intercept shifts for the Group 1 districts were also larger than those for the Group 5 districts, though not statistically so. In general, Groups 1-3 had markedly larger intercept shifts than Groups 4-5. In this backdrop of convergence in revenues following the reform, we investigate its impact on spending in various component expenditure categories in Groups 1-5.

Table 4 studies the impact of the reform on the components of total current expenditures: instructional expenditure, support services expenditure, and other elementary-secondary expenditure. As earlier, odd-numbered columns include all 524 school districts, while even-numbered columns exclude Detroit. Columns (1)-(6) present the impacts on per pupil spending respectively in each of these three categories; columns (7)-(12) present impacts on shares of each of these categories (where shares are expressed as percentages of total expenditure)[20]. First, consider instructional expenditure per pupil

[20] Note that one should not expect the effects across the shares of the three categories to sum to zero as the share

(columns (1)-(2)). While the group 5 intercept shift is larger than those for Groups 1 and 2, the post-reform trend increases of these lower spending districts more than compensate the intercept differences. In fact, consistent with the markedly higher (post-reform) trend in total revenues in Group 1 districts compared to Group 5 districts (Table 2), we see a higher trend in instructional expenditure per pupil in the low spending districts relative to the high spending districts. The difference in trend is not only economically significant, but statistically significant too. Moreover, there is a strict hierarchy in the post-reform trends with Group 1 trends exceeding Group 2 trends, Group 2 trends exceeding Group 3 trends and so on and so forth.

For support services expenditure per pupil (columns (3)-(4)), only Groups 1 and 3 show economically and statistically significant intercept shifts and these shifts exceed those of the other groups economically, but not statistically. Similar to patterns for instructional expenditure per pupil, the trend shifts for support services expenditure per pupil for the low spending groups 1-2 (relative to pre-reform trends) exceed, by far, those in the high spending groups (Groups 4-5). In fact the Group 1 trend shift exceeds the corresponding Group 5 trend shift statistically too.

For other elementary-secondary expenditure per pupil, none of the intercept shifts are statistically significant; the trend shifts for all the groups are negative and statistically significant, but notably the trend shifts for the low spending groups (Groups 1 and 2) once again exceed those of the corresponding high spending groups economically, though never statistically. To summarize the effects in the first six columns of the table, for each expenditure category the low spending groups exhibit higher trend shifts in the post-reform period than the higher spending groups, and the Group 1 trend shifts not only exceed the Group 5 trend shifts economically but, in most cases, statistically too. This higher trend shift in each case may be a consequence of the higher post-reform revenue trends in Group 1 districts relative to those in Group 5 (Table 3).

Patterns in spending shares are better indicators of school district productivity or efficiency as

variables are expressed as percentages of total expenditure, not total current expenditure (so the shares do not sum to 100). On the other hand the shares (dependent variables) in Table A1 are expressed as percentages of total current expenditure – consequently these shares sum to 100 and post-reform effects for each group across the different categories sum to zero.

changes in shares reflect conscious school district attempt to re-allocate spending among the various expenditure categories. To explore this line of enquiry, we next look at the impact of the reform on spending shares in each of the above categories. Interestingly, the patterns for shares are quite different from the patterns for per pupil spending. First, consider instructional spending shares. The trend shifts for the different groups are quite similar, always negative, small, and never statistically significant. In contrast, the high spending groups (Groups 4 and 5) show larger intercept shifts relative to the low spending groups following the reform, though these differences are not statistically significant. This pattern suggests that the high spending groups may have consciously allocated a larger share of their total expenditure to instructional expenditure following the reform. This is indicative of an increase in productivity of these districts, given that instructional expenditure is regarded as the more productive category (see section 5).

For support services shares, while none of the intercept shifts are statistically significant, the trend shifts show interesting patterns. Low spending groups show higher trend increases for support services shares than the high spending groups – a pattern very different from instructional shares. There does not seem to have been much discernible changes in shares of other elementary-secondary expenditure. The finding of larger trend increases for support services share in the low spending groups in the post-reform period squares well with the increases in instructional spending share in the high spending districts obtained above – together they suggest a relative increase in productivity in the high spending groups.[21]

Table 5 explores the impacts on support services further by studying the impact on the various components of support services spending. For each spending category, the first column includes all districts while the second excludes Detroit (the largest district in the state). Since spending shares are more instructive in gauging the behavior of the districts, this table focuses on shares only (rather than per pupil spending). For pupil support service shares, the high spending groups (Groups 4 and 5) show larger intercept declines as well as steeper trend declines than the low spending groups (Groups

[21] It is worth noting here that the low spending districts seem to have lost productivity as evidenced in the statistically significant trend increases in the support services shares.

1 and 2), and the trend shift for Group 1 is also statistically different from Group 5. For instructional staff support share, once again the high spending groups show larger intercept declines than Group 1, though Group 2 intercept shift is essentially the same as Group 5. Groups 4 and 5 show sharper trend declines for instructional staff support share than Groups 1 and 2, though none of these differences are statistically significant. For general administration spending, Groups 1 and 2 show marginally larger intercept declines than Groups 4 and 5, but Group 5 shows a slightly larger trend decline than Group 1.[22] For school administration support share, high spending districts show larger declines in both trend and intercept. For operation-maintenance support share, Groups 1 and 2 show slightly higher intercept declines than Group 5, although these are not statistically different between groups. In contrast, Group 5 show considerably steeper trend declines in operation-maintenance support share in the post-reform period than Groups 1 and 2, and the Group 5 trend shifts are also statistically different from those of these groups. For business support share, once again Group 5 districts show a perceptibly higher trend decline than the other groups. In fact the trend shifts are positive for the other groups and negative for only Group 5. The Group 5 trend shifts are also statistically different from the corresponding Group 1-3 shifts. It is worth noting here that in the pre-reform period, operation-maintenance support was the largest support services category (Table 1), school administration support was the second largest followed by pupil support services. In each of these categories, the high spending groups show markedly sharper trend declines than low spending districts in the post-reform period, and these differences are often statistically different from zero.

Since the treatment effects here constitute of two effects (intercept and trend shifts), a useful way to understand and compare the treatment effects is to compute total treatment effects. Table 6 presents total treatment effects after each of 1,2,3,...,7 years (obtained by computing $(\gamma_{2kg} + \gamma_{3kg} * t)$) for Groups 1 and 5 and their differences. Columns (1)-(3) relate to total treatment effects for instructional share, while the other columns relate to total treatment effects for the shares of the various support services spending discussed above. Columns (1)-(3) show that the total treatment effects for Group 5 in each of the post reform years exceed those for Group 1, although these differences are not statistically significant.

[22] Groups 2 and 3 show the largest trend declines in general administration share.

The pictures for the support services categories are very different (columns (4)-(18)). For each of the support service shares, the total treatment effects for Group 5 in each of the post-reform years lag the corresponding Group 1 effects, even statistically so in some cases.

The difference in total treatment effects between Groups 5 and 1 (and corresponding confidence intervals) are also graphically depicted in Figure 2. As in Table 6, Panel A in Figure 2 shows that in the post-reform period instructional share in Group 5 exceeded the corresponding Group 1 share in each of the post-reform years, but these differences were not statistically significant. Consistent with Table 6, Figure 2 Panels (B)-(F) show that the Group 5 share in each of the component support services category was less than the corresponding Group 1 share consistently in each of the years after program, and these differences were also sometimes statistically significant.

Figure 3 plots the predicted values from specification (3) for Groups 1 and 5 for the various component support services shares. For pupil support services share (Panel A), Group 5 had a steeper pre-reform trend. But this was reversed in the post-reform period with Group 5 districts showing a relatively steeper decline. For instructional staff support (Panel B), the increasing trend in the pre-reform period continued, but the Group 5 districts showed a relative decline in trend (compared to the Group 1 districts) in the post-reform period. For each of the other component support services shares too (Panels C-F), Group 5 districts showed marked declines in trend relative to Group 1 districts in the post-reform period.

The above analysis reveals that the school finance reform led the high spending school districts to increase their share of instructional spending and decrease their shares of various forms of support services spending relative to low spending groups. This suggests that the reform led to a relative increase in productivity (or efficiency) in the high spending groups.[23,24] While the decline in spending growth

[23] It is important to note that an increase in productivity does not by itself imply an increase in welfare. Given revenue constraints, the high spending school districts may have cut back on some of their "boutique" offerings – say, generous support for instructional staff – and instead focused on "the basics". But residents in these districts might have been willing to pay for these, and might seek out other options. The lack of private school entry suggests that these welfare losses (if any) were not large, although some of these previous offerings may have been replaced by after-school tutoring and private lessons.

[24] Following the literature (U.S. Department of Education (2009), Weber and Ehrenberg (2009), Welsch (2011), Chakrabarti and Sutherland (2013)), we have regarded the instructional spending category as the more productive spending category. It is important to note though that schools are now facing increasing incidence of "special needs" such as

due to the reform in the high spending districts may have adversely affected incentives to increase effort, there were other forces at work too. Spending declines may adversely affect demand for these districts, as households value school spending. Anticipating a decline in enrollment (which would further decrease revenue and correspondingly lead to further declines in enrollment thus leading to a downward spiral), high spending school districts had an incentive to increase effort to attract (and retain) their customers thus preventing the downward spiral (section 3). It seems the latter force may have prevailed for the high spending districts in Michigan in the post-reform period.

Note that this finding of substitution away from support services spending and towards instructional spending in the high spending districts (relative to the low spending districts) in the post-reform period is not at odds with the literature that finds test score improvements in low spending districts and declines in high spending districts (Papke (2004), Roy (2011)). Despite a relative decline in instructional share in low spending districts (in comparison to the high spending districts), the low spending districts experienced an influx of money that resulted in a marked increase in funds devoted to most spending categories including instruction (Table 4, columns (1)-(4)). Increase in dollar amounts may have allowed the districts to avail of more and better classroom services, lab equipment, teachers etc which in turn may have positively affected test scores. Similarly while high spending districts increased their share of instructional spending and decreased that of support services spending, they faced a sharp decline in trend in both total spending per pupil (Table 2) as well as instructional spending per pupil (Table 4, columns (1)-(2)). These may have affected test scores negatively in these districts – spending a higher share on instructional expenditures and a lower share on support services were not sufficient to outweigh the negative impact of a large decline in spending growth. Also spending in these various categories is not the only factor that affects test scores. Quality of teachers, quality of classroom materials, quality of peers etc. matter too. The impacts of the reform on these factors are beyond the scope of this paper, nor is there consensus on the education production function and its form.

behavioral problems, autism etc. While special education teacher salaries (which constitute the bulk of special needs spending) are included in instructional spending, some forms of special needs spending may be included in the non-instructional spending category. However, it is also worth noting that the rise in importance of special needs is a recent phenomenon and the incidence and importance of special needs were much less in the period we are studying (1990-2001).

Table 7 presents the impact of the reform using the continuous metric "ratio" and specification (4). This table again focuses on spending shares (rather than per pupil spending) in various categories as changes in shares reflect conscious effort by the school district and hence serve as better indicators of productivity change. Panel A looks at the impact on the shares of the three components of current expenditure – instructional expenditure share, support services share, and other elementary-secondary services spending share. The results in this table mirror those obtained above. An increase in pre-reform spending (as reflected by an increase in "ratio") is associated with higher post-reform trends as well as intercept shifts (though not statistically significant) for the share of instructional spending. In other words, districts with higher pre-reform spending allocated a higher share of spending to instructional expenditure in the post-reform period relative to pre-reform trends and in comparison to districts with lower pre-reform spending. In contrast an increase in pre-reform spending was associated with post-reform trend declines in support spending shares.[25] No statistically or economically meaningful shifts are observed for other elementary-secondary expenditure shares.

Panels B and C study the impacts on the different categories of support services spending. Once again the results obtained are similar to those obtained above (Table 5). Panels B and C find that districts with higher pre-reform spending allocated a lower share of their spending to the different support service categories in the post-reform period after controlling for pre-reform trends and in comparison to districts with lower pre-reform spending. In most cases both the intercept and trend shifts were negative. In cases where the intercept shift was positive, the negative trend shift more than offset the intercept shift after at most two years.[26] Overall, the results of this table mimic the results obtained above in Tables 4-7, thus increasing confidence in our findings. It is noteworthy though that specification 4 (and hence results in Table 7) assume linearity of reform effects in pre-reform spending distribution. In other words, equidistant districts located in different parts of the spending distribution are assumed

[25] Note that while an increase in pre-reform spending was associated with positive intercept shifts for support services share, this was more than offset by the negative trend shift after two years.

[26] The only exception was general administration support share where both the trend and intercept shifts were positive. However note that both these shifts were economically small and were never even close to statistically significant. Also general administration share only contributed a small portion of spending, being the smallest category of support services spending.

to have same incremental effects. But the qualitative similarity of the results between specifications (3) and (4) are encouraging, and attests to the robustness of the effects.

Figure 4 presents predicted value plots for the 20th and 80th percentiles of "ratio". The results mimic the patterns obtained above. The 80th percentile districts show a relative decline in support services spending share in each of the categories in the post-reform period (relative to the 20th percentile districts).

As mentioned above, the various spending shares in Tables 4, 5, 7 are obtained by expressing the corresponding spending variables as percentages of total expenditure. We also follow an alternative strategy where we express these spending variables as percentages of total current expenditure. One advantage of this approach is that the shares of the components of current expenditures sum to 100 and the corresponding impact coefficients sum to zero. Appendix Table A1 looks at the impact of the reform on the shares of the three components of current expenditures using specification (3). The results mirror closely the results obtained above with alternative share definition. Table A1 finds once again that for instructional share, high spending districts exhibited higher post-reform intercept shifts than low spending districts. While all groups showed trend declines (for instructional share) in the post-reform period, the trend declines were the lowest for the high spending groups. Calculation of total treatment effects reveals that once again the total treatment effects for instructional spending share for high spending districts exceeded those for the low spending districts in each of the years after reform. In other words, in the post-reform period the high spending districts devoted a higher share of their current expenditures to instructional spending relative to low spending districts (after controlling for corresponding pre-reform trends).

In contrast, Appendix Table A1 columns (3)-(4) show larger intercept declines as well as slower trend increases for high spending districts relative to low spending districts in support services share, again consistent with the results obtained above. No definite patterns are discernible for other elementary-secondary expenditure except that all groups showed a decline. The patterns confirm that the reform led high spending districts to focus more on instructional spending at the expense of support services

spending relative to low spending groups (after controlling for pre-reform trends).

Appendix Table A2 looks at the impact on the shares of the various support service components, shares being expressed as percentages of total current expenditure. Once again the patterns in the table as well as calculation of total treatment effects (available on request) reveal larger declines in shares of each of the component support services spending in high spending districts relative to low spending districts in the post-reform period[27]. Appendix Table A3 looks at the impact on the component support services spending shares using specification (4). As in Table 7, higher pre-reform spending is associated with larger declines in post-reform shares of the various component support service categories[28]. Thus the results in Tables A1-A3 are qualitatively similar to those obtained in Tables 4-7, and give us further confidence in the results above.

7 Sensitivity Checks

In this section, we study other potentially confounding factors, and investigate their roles in explaining the patterns above.

7.1 Were differential movements to private schools across school districts important?

One important factor that could potentially bias our results is if there were any differential trends in movement to private schools between the different groups of districts following the school finance reform. While the existing evidence is mixed (Sonstelie (1979), Sonstelie, Brunner, and Ardon (2000), Downes and Schoeman (1998), Schmidt (1992)), it is possible, for example, that the constraints on local spending imposed by a school finance reform on the highest-spending districts induced some families to exit the public sector and enroll their children in private schools. In this case, changes in resource allocation may at least partly reflect the changed student composition of the district rather than the

[27] The only exception is general administration support share where the Group 5 districts showed small increases in shares in the post-reform period relative to the Group 1 districts, but these effects are small and never statistically significant. Also as noted above, general administration was the smallest component of support services spending, and constituted a very small share of total spending.

[28] Again the only exception was general administration support share where both the trend and intercept shifts were positive. However both these shifts were economically small and never statistically significant.

direct effect of limits on local discretion.

We use the decennial census data to look at any differential change in private school enrollment across Michigan school districts between 1990 and 2000. The results are presented in Table 8. Group 3 is taken as the omitted category. There is no evidence of differential trends in either the low spending districts or in the high spending districts. The coefficients are always small and never statistically significant. Overall, it looks unlikely that changes in private school enrollment are driving the results obtained above.

7.2 Was there differential private school entry?

A related question is whether there was differential private school entry across the different groups of districts in the aftermath of the school finance reform. It is conceivable that private schools would look upon the post-reform era as an opportunity to attract public school students and choose to enter the market, especially in districts that became less attractive following the school finance reform. Such differential entries can bias the results obtained above. In this section, we investigate whether there was any evidence of differential entries of private schools across different groups of districts in the post-reform period.

We use private school survey (PSS) data collected by the National Center for Education Statistics of the U.S. Department of Education for this purpose. First, we obtained private school location data (street addresses) for the years 1990 through 2000 from the PSS, and used ArcGIS to geocode each private school address. The resulting private school map was then overlaid on a map of Michigan school districts obtained from the Census Bureau, and the number of private schools in each school district was counted using ArcGIS. Using data from 1990 through 2000, we next determine whether there were differences in private school entry trends across the different groups of districts in the post-reform period. We use specification (2) for this estimation, where the dependent variable is the number of private schools in a school district and Group 3 is the omitted category. The results are presented in Table 9. There is no evidence of any differential trends in private school entries across the various groups of districts. In particular, private schools do not seem to have differentially entered in the

highest-spending districts, which were the most constrained by Proposal A.

7.3 Investigating the role of charter schools

Another important institutional change that took place in the mid-1990s was the entry of charter schools. The competitive effect of charter schools can potentially induce public schools to change the allocation of their resources. In such a case, the results obtained above can at least be partially driven by the entry of charter schools. Was this indeed the case?

However, even though charter schools proliferated in Michigan, they still served only a small fraction of overall K-12 students (Arsen et al. 2001). But, more importantly, charter schools were not evenly spread out through the state. Rather, they were predominantly located in southeast Michigan, particularly in Wayne County, where they served mostly students living in the poorer suburbs or inner-city Detroit (Cullen and Loeb (2004)). To test the robustness of our results to charter school entry, we separately exclude (i) Wayne county and (ii) Detroit school district from our analysis, and investigate whether our results are sensitive to these exclusions. As seen in the tables above, the results are not sensitive to the exclusion of Detroit school district. The results also remain very similar when we exclude Wayne county instead. They are not reported here for lack of space, but are available on request. So charter schools are unlikely to have driven the results seen above.

In addition, to further probe whether the spread of charter schools contributed to some of the results obtained above, we re-estimate the regressions above, but now we also explicitly control for number of charter schools in the district. To further control for any private school entry that may have taken place (in an effort to confirm the results in the previous section), we also include the number of private schools in a district as an additional control. The results from this analysis are reported in Appendix Tables A4 and A5 – they respectively report results from estimations of specifications (3) and (4).[29] As can be seen, the results remain qualitatively similar to those obtained above. They further confirm that the results above are not driven by charter or private school entry.

[29] For lack of space, in these tables we report the impacts on the shares of the various components of support services. The results for the other variables are similar to those obtained above and are available on request.

7.4 Investigating the role of inter-district choice

Michigan also had an inter-district choice program. However, it was very small – only about 1 percent and 1.5 percent of Michigan public school students enrolled in public schools outside their home district in 2000 and 2001, respectively (see Arsen et al. 2001). As was the case with charter schools, public school choice too was concentrated mainly in and around Detroit. As Cullen and Loeb (2004) note, "Student participation in schools of choice has largely been a Detroit phenomenon, with more than one-third of all transfers taking place within the Detroit metropolitan area." The results obtained above are robust to the exclusion of the Detroit metropolitan area. The results are not reported here to save space, but are available on request.

7.5 Did the Decline in Michigan's Manufacturing Sector Affect Results?

A potential confounding factor is the secular decline in auto and manufacturing industries in Michigan throughout the last two decades. This decline could have potentially affected revenues and expenditures, as well as resource allocation differently in the different groups of school districts. If this was indeed the case, then the results obtained above could have been confounded with the effects of the decline in Michigan's manufacturing industries.

Note though that most of the secular decline in manufacturing jobs in Michigan occurred after 2000. For example, as Glazer and Grimes (2004) show, manufacturing employment in Michigan stood at 837,600 in 1990 and increased to 896,700 in 2000 – an increase of about 59,000 jobs over 10 years – though this was followed by a large decline in the early part of the last decade. Since we are looking at the period prior to 2001, our analysis is unlikely to be significantly biased by this factor.

Nevertheless, we investigate the role of the decline in Michigan's manufacturing sector more closely in this section. Using decennial census data, we look at the trends in the percentage of workforce employed in manufacturing, and examine if there were differential post-program trends in manufacturing employment in the different groups of districts (relative to their pre-existing trends).

The results are presented in Table 10. They show that there was a small general increase between 1990 and 2000 (relative to that between 1980 and 1990). However, there is no evidence of any differential

change in the post-reform period across the various groups of districts. All of the post-reform coefficients are small, and are never statistically different from zero. In sum, the decline in Michigan's manufacturing industry does not seem to have been the impetus behind the results above.

8 Conclusion

Over the past 40 years, school finance reforms have become a ubiquitous feature of the K-12 education system in the United States. The direct motivation for these reforms is generally the desire to reduce disparities in per pupil spending across districts within a state, and to lessen the burden of local property taxes. As a result of these reforms, low-spending districts typically receive significant increases in state aid, while high spending districts face limits on their spending growth. These changes have the potential to significantly change incentives and behavior of school districts, affecting their resource allocation and productivity. In this paper, we study (both theoretically and empirically) whether this has been the case.

We focus on Proposal A in Michigan, which ranks as one of the most important and comprehensive school finance reforms undertaken over the past four decades. In this paper, we study the impact of Proposal A on resource allocation by Michigan school districts. Since districts located at different parts of the pre-reform spending distribution were affected very differently by the reform, one would expect them to face different incentives and hence respond differently. Following this cue, we differentiate between responses of school districts located at different parts of the pre-reform spending distribution.

Our results show that the reform led high spending districts to decrease the share of support services expenditure and increase the share of instructional expenditure (relative to low spending districts). This substitution away from support services spending (which is regarded as less productive) to instructional spending (which is believed to be more closely tied to student learning) suggests that the reform induced the high spending districts to be more productive. Why might this have been the case? Our theoretical model suggests that there are multiple mechanisms by which school finance reforms affect incentives and responses of districts not all of which may be working in the same direction. First, a decrease in

the growth rate of spending as faced by the high spending districts, may have acted as a disincentive encouraging a reduction in effort. But at the same time the districts realize that a reduction in effort along with a reduction in spending may adversely affect demand for the district, and hence enrollment and ultimately revenue. The latter channel would encourage schools to increase effort (or productivity), and seems to have prevailed in post-reform Michigan.

These results have important policy implications. They suggest that school finance reforms affect incentives and responses (as captured by resource re-allocation) of school districts. Moreover, school districts located at different points of the pre-reform spending distribution were affected differently and in turn, responded differently. Policymakers need to take these different responses into account when designing school finance reforms and other related policies that aim at spending equalization between districts.

Appendix A: Proofs of results

Proof of Proposition 1. The net revenue function of a public school district is given by $R = p.N\big[E(p, e, V(e), .), e\big] - \Big[c_1 + c\Big[N[E(p, e, V(e), .), e]\Big] + C(e)\Big]$. It follows that there exists a unique effort e^* such that it solves the first order condition:

$$\frac{\delta R(e, .)}{\delta e} = (p - c_N)[N_E(E_e + E_V V_e) + N_e] - C_e(e) = 0$$

Note that

$$\frac{\delta^2 R(e, .)}{\delta e^2} = (p - c_N)[N_E[E_{ee} + E_{VV} V_e^2 + E_V V_{ee}] + N_{EE}[E_e + E_V V_e]^2 + N_{ee}] - c_{NN}[N_E(E_e + E_V.V_e) + N_e]^2 - C_{ee} < 0$$

from the strict concavity of $N(.)$, $E(.)$, $V(.)$ functions and convexity of the cost function in their respective arguments. It follows that the second order condition is satisfied.

Using the first order condition to do comparative statics with respect to p, we obtain:

$$\frac{\delta e}{\delta p} = -\frac{N_E[E_e + E_V V_e] + N_e + (p - c_N) N_{EE} E_p (E_e + E_V V_e) - c_{NN}[N_E E_p[N_E(E_e + E_V V_e) + N_e]]}{(p - c_N)[N_E[E_{ee} + E_{VV} V_e^2 + E_V V_{ee}] + N_{EE}[E_e + E_V V_e]^2 + N_{ee}] - c_{NN}[N_E(E_e + E_V.V_e) + N_e]^2 - C_{ee}}$$

(A.1)

The denominator is negative from strict concavity of the rent function. Note that $(p - c_N) > 0$ from the first order condition. The first two terms of the numerator are positive, the third term is negative due to strict concavity of the $N(.)$ function, and the last term is negative due to strict convexity of the cost function. It follows that $\frac{\delta e}{\delta p} \gtrless 0$.

■

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Table 1: Summary Statistics for Different Groups of Michigan School Districts in the Pre-reform Period

	All Groups	Group 1 Lowest Spending Group	Group 2 Lower Middle Group	Group 3 Middle Group	Group 4 Upper Middle Group	Group 5 Highest Spending Group
Per Pupil Expenditure						
Total Expenditure PP	5764	4388	4847	4952	5896 [5888]	7038
	(1407)	(856)	(1059)	(925)	(874) [(1043)]	(1397)
Instructional Exp. PP	2788.64	2249.80	2377.27	2491.45	2855.12 [2803.72]	3281.07
	(492.83)	(147.03)	(150.23)	(173.96)	(258.11) [(293.10)]	(540.52)
Support Services Exp. PP	1865.21	1247.45	1395.06	1430.77	2009.95 [1920.72]	2390.47
	(551.16)	(152.46)	(229.56)	(189.64)	(370.90) [(410.96)]	(486.23)
Other Elem/Sec Exp. PP	244.67	234.02	243.82	245.23	239.51 [267.02]	256.10
	(123.72)	(66.63)	(62.97)	(170.78)	(135.52) [(153.58)]	(116.62)
Shares of Spending (%)						
Instructional Exp. Share	49.55	52.41	50.62	51.58	49.05 [48.52]	47.38
	(6.66)	(6.70)	(7.85)	(7.62)	(5.40) [(6.36)]	(6.24)
Support Services Exp. Share	32.36	28.99	29.52	29.34	34.22 [32.82]	34.29
	(5.24)	(4.24)	(5.18)	(3.80)	(4.77) [(5.07)]	(4.88)
Other Elem/Sec Exp. Share	4.44	5.44	5.26	5.01	4.12 [4.62]	3.76
	(2.10)	(1.55)	(1.64)	(2.34)	(2.26) [(2.53)]	(1.79)
Pupil Support Services Share	4.47	2.64	3.25	3.26	5.33 [5.07]	5.32
	(1.90)	(1.00)	(1.41)	(1.20)	(1.88) [(2.19)]	(1.52)
Instructional Staff Support Share	3.23	2.22	2.55	2.62	3.45 [4.01]	4.02
	(1.67)	(1.10)	(1.50)	(1.28)	(1.91) [(2.04)]	(1.33)
General Admin. Support Share	1.88	2.62	2.50	2.47	1.34 [1.66]	1.69
	(1.29)	(1.29)	(1.30)	(1.29)	(1.09) [(1.15)]	(1.15)
School Admin. Support Share	5.45	5.28	5.01	5.36	5.92 [5.06]	5.15
	(1.33)	(1.13)	(1.14)	(1.03)	(1.65) [(1.16)]	(0.98)
Oper. & Maint. Supp. Share	10.30	9.01	9.13	9.35	10.87 [9.86]	11.16
	(2.34)	(2.43)	(1.93)	(1.83)	(2.16) [(1.78)]	(2.33)
Business Support Share	3.03	2.17	2.41	2.25	3.26 [3.30]	3.81
	(1.53)	(1.33)	(1.41)	(1.17)	(1.06) [(1.27)]	(1.85)
Demographics						
% White	77.84	93.61	91.46	93.71	58.21 [79.92]	82.11
	(30.30)	(7.02)	(15.60)	(5.77)	(37.79) [(20.86)]	(23.90)
% Black	16.54	1.73	3.18	1.37	35.27 [12.92]	12.54
	(29.65)	(4.80)	(14.71)	(3.58)	(37.46) [(17.42)]	(23.85)
% Hispanic	1.89	1.77	1.64	1.66	2.93 [3.32]	0.81
	(3.25)	(2.97)	(3.32)	(3.26)	(3.84) [(4.52)]	(1.76)

Figures represent means (weighted by enrollment). Standard deviations are reported below in parentheses. For group 4, the figures in square brackets exclude Detroit. Detroit is the largest school district in Michigan, alone accounting for about 10% of the total student population in the state. Shares relate to percentages of total expenditure. For more discussion, see sections 4 and 5.

Table 2: Pre-reform Trends in Per Pupil Revenues and Expenditures across Michigan School Districts

	Total Revenue Per Pupil	
	(1)	(2)
Group 1 * t	263.67***††	263.67***††
	(24.39)	(24.39)
Group 2 * t	297.42***††	297.42***††
	(20.73)	(20.73)
Group 3 * t	329.62***	329.62***
	(31.13)	(31.13)
Group 4 * t	438.50***	446.92***
	(28.39)	(39.38)
Group 5 * t	446.91***	446.91***
	(67.21)	(67.21)
Observations	1047	1045
R-squared	0.91	0.91

*, **, ***: significant at the 10, 5, and 1 percent levels respectively. †, ††, †††: Group 5 coefficients statistically different from other group coefficients at 10, 5, and 1 percent levels respectively. Odd numbered columns include all 524 school districts, while even numbered columns exclude Detroit, which is the largest district in the state (accounting for about 10% of the total number of students in the state). Results are obtained from estimation of model 1. 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.

Table 3: Impact of the Michigan School Finance Reform on Per Pupil Revenue

	Total Revenue Per Pupil	
	(1)	(2)
Group 1 * reform	339.709***	345.838***
	(96.265)	(95.644)
Group 2 * reform	438.753***	442.435***
	(94.667)	(98.576)
Group 3 * reform	501.966***	501.880***
	(133.096)	(131.636)
Group 4 * reform	259.294*	191.935
	(151.349)	(168.924)
Group 5 * reform	256.125	290.434
	(211.530)	(202.474)
Group 1 * reform * t	110.756***†††	107.935***†††
	(30.308)	(30.308)
Group 2 * reform * t	15.106††	13.015††
	(31.147)	(32.092)
Group 3 * reform * t	-67.408*	-69.625*
	(38.692)	(37.707)
Group 4 * reform * t	-131.044***	-160.210***
	(41.652)	(46.914)
Group 5 * reform * t	-173.242**	-157.337**
	(73.208)	(67.438)
Number of observations	4708	4699
R-squared	0.940	0.938

*, **, ***: significant at the 10, 5, and 1 percent levels respectively. †, ††, †††: Group 5 coefficients statistically different from other group coefficients at 10, 5, and 1 percent levels respectively. Odd numbered columns include all 524 school districts. Even numbered columns exclude Detroit, which is the largest district in the state (accounting for about 10% of the total number of students in the state). Results are obtained from estimation of model 2. All regressions are weighted by district enrollment, include district fixed effects, and control for enrollment and ethnicity.

Table 4: Impact of Michigan School Finance Reform on Components of Total Current Expenditures

	Instructional Exp. Per Pupil		Support Services Exp. Per Pupil		Other Elem/Sec Exp. Per Pupil		Instructional Share (%)		Supp. Serv. Share (%)		Other Elem/Sec Exp. Share (%)	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Group 1 * reform	264.594***	266.188***	73.929*	76.823**	-2.683	-2.093	1.873	1.869	0.540	0.551	-0.256	-0.252
	(54.699)	(53.321)	(37.785)	(36.202)	(13.123)	(13.013)	(1.830)	(1.828)	(1.058)	(1.055)	(0.296)	(0.296)
Group 2 * reform	288.213***	287.983***	67.100	68.674	-14.252	-13.843	3.529*	3.525*	1.154	1.164	-0.534*	-0.532
	(47.257)	(46.673)	(42.380)	(42.511)	(14.101)	(14.108)	(1.918)	(1.921)	(1.047)	(1.051)	(0.320)	(0.323)
Group 3 * reform	355.641***	354.406***	151.302***	150.670***	-34.760	-34.671	2.364	2.368	1.509	1.511	-0.814*	-0.812*
	(56.944)	(55.883)	(41.535)	(39.979)	(28.861)	(28.881)	(2.080)	(2.082)	(1.189)	(1.186)	(0.438)	(0.438)
Group 4 * reform	489.333*	235.569***	-138.993	16.735	-9.566	-11.631	6.005**	3.046**	-1.851	0.689	-0.205	-0.296
	(288.863)	(86.474)	(119.591)	(80.003)	(32.227)	(37.632)	(2.950)	(1.508)	(2.140)	(1.158)	(0.580)	(0.631)
Group 5 * reform	304.426***	312.597***	45.259	60.589	2.463	6.693	3.751**	3.787**	1.142	1.206	-0.021	0.018
	(71.799)	(72.406)	(70.339)	(67.610)	(37.537)	(35.076)	(1.566)	(1.568)	(1.167)	(1.180)	(0.505)	(0.484)
Group 1 * reform * t	29.978*†††	28.468*†††	74.156***†††	72.823***†††	-7.658**	-8.037**	-0.819	-0.828	0.982***	0.980***	-0.039	-0.043
	(17.480)	(17.012)	(12.274)	(11.583)	(3.836)	(3.828)	(0.560)	(0.560)	(0.317)	(0.316)	(0.093)	(0.093)
Group 2 * reform * t	-16.380††	-18.014††	40.402***	39.178***	-13.773***	-14.004***	-0.535	-0.540	0.946***	0.946***	-0.135	-0.137
	(16.663)	(16.370)	(13.954)	(13.887)	(4.578)	(4.552)	(0.567)	(0.568)	(0.319)	(0.320)	(0.099)	(0.100)
Group 3 * reform * t	-30.371	-32.263*	31.444**	29.942**	-17.840**	-18.027**	-0.131	-0.132	1.188***	1.187***	-0.128	-0.129
	(19.097)	(18.614)	(14.043)	(13.218)	(7.750)	(7.742)	(0.574)	(0.574)	(0.340)	(0.338)	(0.126)	(0.126)
Group 4 * reform * t	-64.709	-70.448**	-64.340**	-43.298	-16.014*	-22.568**	-0.105	-0.265	0.196	0.318	-0.020	-0.111
	(91.736)	(33.208)	(32.344)	(31.425)	(8.223)	(9.953)	(0.856)	(0.445)	(0.575)	(0.359)	(0.166)	(0.181)
Group 5 * reform * t	-79.387***	-78.223***	-7.046	-0.701	-21.004*	-18.952**	-0.708	-0.695	0.548	0.585	-0.115	-0.097
	(25.105)	(24.582)	(26.755)	(24.506)	(10.801)	(9.503)	(0.472)	(0.474)	(0.350)	(0.358)	(0.145)	(0.135)
Number of observations	4708	4699	4708	4699	4708	4699	4708	4699	4708	4699	4708	4699
R-squared	0.951	0.955	0.943	0.948	0.441	0.431	0.488	0.448	0.616	0.608	0.587	0.578

*, **, ***: significant at the 10, 5, and 1 percent levels respectively. †, ††, †††: Group 5 coefficients statistically different from other group coefficients at 10, 5, and 1 percent levels respectively. Odd numbered columns include all 524 school districts. Even numbered columns exclude Detroit, which is the largest district in the state (accounting for about 10% of the total number of students in the state). Results are obtained from estimation of model 3. Shares relate to percentages of total expenditure. All regressions are weighted by district enrollment, include district fixed effects, and control for enrollment and ethnicity.

Table 5: Impact of the Michigan School Finance Reform on Components of Total Support Service Expenditure

	Pupil Support Share (%)		Instructional Staff Support Share (%)		General Admin. Support Share (%)		School Admin. Support Share (%)		Op./Maintenance Support Share (%)		Business Support Share (%)	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Group 1 * reform	-0.279	-0.272	-0.628***	-0.633***	-0.352**	-0.350**	-0.622	-0.620	-0.683**	-0.686**	-0.216*	-0.214*
	(0.208)	(0.207)	(0.198)	(0.197)	(0.158)	(0.157)	(0.388)	(0.387)	(0.271)	(0.270)	(0.124)	(0.124)
Group 2 * reform	-0.306	-0.298	-0.930***	-0.933***	-0.362**	-0.360**	-0.325	-0.322	-0.739***	-0.742***	-0.169	-0.167
	(0.259)	(0.258)	(0.222)	(0.223)	(0.174)	(0.175)	(0.266)	(0.265)	(0.221)	(0.221)	(0.197)	(0.197)
Group 3 * reform	-0.281	-0.278	-0.565***	-0.565***	-0.582***	-0.581***	-0.607**	-0.606**	-0.664***	-0.667***	-0.225*	-0.225*
	(0.322)	(0.322)	(0.206)	(0.209)	(0.170)	(0.170)	(0.259)	(0.258)	(0.232)	(0.232)	(0.121)	(0.122)
Group 4 * reform	-2.087	-0.858	-1.208**	-1.601**	-0.171	-0.198	-1.535*	-0.658	-1.026**	-0.543***	0.349	0.113
	(1.484)	(0.547)	(0.528)	(0.677)	(0.111)	(0.133)	(0.844)	(0.409)	(0.441)	(0.194)	(0.393)	(0.174)
Group 5 * reform	-0.684**	-0.675**	-0.922***	-0.952***	-0.246	-0.229	-0.772***	-0.763***	-0.534**	-0.536**	-0.077	-0.076
	(0.309)	(0.315)	(0.280)	(0.289)	(0.175)	(0.178)	(0.232)	(0.234)	(0.253)	(0.255)	(0.161)	(0.158)
Group 1 * reform * t	-0.290***††	-0.285***††	-0.123**	-0.121*	-0.084*	-0.086*	-0.358***	-0.357***	-0.026†††	-0.027†††	0.038***†††	0.035***†††
	(0.063)	(0.062)	(0.063)	(0.062)	(0.050)	(0.050)	(0.107)	(0.106)	(0.027)	(0.027)	(0.014)	(0.014)
Group 2 * reform * t	-0.381***	-0.377***	-0.156**	-0.154**	-0.143***	-0.143***	-0.388***	-0.387***	-0.039††	-0.040††	0.034*†††	0.033*†††
	(0.085)	(0.084)	(0.066)	(0.066)	(0.051)	(0.051)	(0.085)	(0.084)	(0.030)	(0.030)	(0.019)	(0.019)
Group 3 * reform * t	-0.244**††	-0.241**††	-0.137**	-0.136**	-0.171***	-0.171***	-0.436***	-0.435***	-0.053*††	-0.054*††	0.072***†††	0.070***†††
	(0.102)	(0.102)	(0.064)	(0.065)	(0.050)	(0.050)	(0.074)	(0.073)	(0.028)	(0.028)	(0.018)	(0.017)
Group 4 * reform * t	-0.766	-0.696***	-0.482***	-0.596***	-0.025	-0.047	-0.645**	-0.567***	-0.046	-0.146***	0.067††	-0.021
	(0.487)	(0.241)	(0.171)	(0.216)	(0.037)	(0.046)	(0.266)	(0.186)	(0.078)	(0.026)	(0.049)	(0.022)
Group 5 * reform * t	-0.578***	-0.564***	-0.282***	-0.297***	-0.092	-0.083	-0.534***	-0.526***	-0.142***	-0.143***	-0.049**	-0.057***
	(0.102)	(0.106)	(0.099)	(0.101)	(0.059)	(0.059)	(0.083)	(0.085)	(0.031)	(0.031)	(0.020)	(0.018)
Number of observations	4708	4699	4708	4699	4708	4699	4708	4699	4185	4177	4185	4177
R-squared	0.817	0.846	0.789	0.782	0.837	0.821	0.647	0.591	0.731	0.681	0.727	0.707

*, **, ***: significant at the 10, 5, and 1 percent levels respectively. †, ††, †††: Group 5 coefficients statistically different from other group coefficients at 10, 5, and 1 percent levels respectively. Odd numbered columns include all 524 school districts. Even numbered columns exclude Detroit, which is the largest district in the state (accounting for about 10% of the total number of students in the state). Results are obtained from estimation of model 3. Shares relate to percentages of total expenditure. All regressions are weighted by district enrollment, include district fixed effects, and control for enrollment and ethnicity.

Table 6: Difference (Group 5 - Group 1) in Total Treatment Effects

Number of Years after Reform	Instructional Share (%)			Pupil Support Share (%)			Instructional Staff Support Share (%)		
	Group 5	Group 1	Diff (Grp5 - Grp1)	Group 5	Group 1	Diff (Grp5 - Grp1)	Group 5	Group 1	Diff (Grp5 - Grp1)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
1	3.04	1.05	1.99	-1.26	-0.57	-0.69	-1.20	-0.75	-0.45
	[0.12]	[0.65]	[0.51]	[0.00]	[0.03]	[0.14]	[0.00]	[0.00]	[0.31]
2	2.33	0.23	2.10	-1.84	-0.86	-0.98	-1.49	-0.87	-0.61
	[0.33]	[0.93]	[0.57]	[0.00]	[0.01]	[0.09]	[0.00]	[0.00]	[0.27]
3	1.63	-0.58	2.21	-2.42	-1.15	-1.27	-1.77	-1.00	-0.77
	[0.57]	[0.86]	[0.61]	[0.00]	[0.00]	[0.07]	[0.00]	[0.01]	[0.25]
4	0.92	-1.40	2.32	-3.00	-1.44	-1.56	-2.05	-1.12	-0.93
	[0.78]	[0.72]	[0.65]	[0.00]	[0.00]	[0.05]	[0.00]	[0.01]	[0.23]
5	0.21	-2.22	2.43	-3.57	-1.73	-1.85	-2.33	-1.24	-1.09
	[0.96]	[0.62]	[0.67]	[0.00]	[0.00]	[0.05]	[0.00]	[0.01]	[0.22]
6	-0.50	-3.04	2.54	-4.15	-2.02	-2.13	-2.62	-1.37	-1.25
	[0.91]	[0.54]	[0.70]	[0.00]	[0.00]	[0.04]	[0.00]	[0.01]	[0.21]
7	-1.21	-3.86	2.66	-4.73	-2.31	-2.42	-2.90	-1.49	-1.41
	[0.80]	[0.48]	[0.71]	[0.00]	[0.00]	[0.04]	[0.00]	[0.01]	[0.21]

Number of Years after Reform	School Admin. Support Share (%)			Op./Maintenance Support Share (%)			Business Support Share (%)		
	Group 5	Group 1	Diff (Grp5 - Grp1)	Group 5	Group 1	Diff (Grp5 - Grp1)	Group 5	Group 1	Diff (Grp5 - Grp1)
	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)
1	-1.31	-0.98	-0.33	-0.68	-0.71	0.03	-0.13	-0.18	0.05
	[0.00]	[0.04]	[0.57]	[0.01]	[0.01]	[0.93]	[0.42]	[0.13]	[0.79]
2	-1.84	-1.34	-0.50	-0.82	-0.74	-0.08	-0.18	-0.14	-0.03
	[0.00]	[0.02]	[0.48]	[0.00]	[0.00]	[0.81]	[0.25]	[0.22]	[0.86]
3	-2.37	-1.70	-0.68	-0.96	-0.76	-0.20	-0.22	-0.10	-0.12
	[0.00]	[0.01]	[0.42]	[0.00]	[0.00]	[0.57]	[0.14]	[0.36]	[0.53]
4	-2.91	-2.05	-0.85	-1.10	-0.79	-0.31	-0.27	-0.07	-0.21
	[0.00]	[0.01]	[0.38]	[0.00]	[0.00]	[0.37]	[0.08]	[0.56]	[0.28]
5	-3.44	-2.41	-1.03	-1.24	-0.81	-0.43	-0.32	-0.03	-0.29
	[0.00]	[0.01]	[0.35]	[0.00]	[0.00]	[0.23]	[0.05]	[0.80]	[0.14]
6	-3.97	-2.77	-1.21	-1.38	-0.84	-0.54	-0.37	0.01	-0.38
	[0.00]	[0.01]	[0.33]	[0.00]	[0.00]	[0.14]	[0.03]	[0.94]	[0.06]
7	-4.51	-3.13	-1.38	-1.53	-0.87	-0.66	-0.42	0.05	-0.47
	[0.00]	[0.00]	[0.31]	[0.00]	[0.00]	[0.08]	[0.02]	[0.70]	[0.03]

This table is derived from results in Tables 4 and 5. It reports total treatment effects for Groups 5 and 1 for each of the post-reform years, and the corresponding differences in total treatment effects in each of these years. P-values corresponding to total treatment effects of respective groups reported in square brackets in first two columns in each set; p-values corresponding to differences in treatment effects of the two groups reported in square brackets in third column in each set.

Table 7: Impact of the Michigan School Finance Reform on Resource Allocation
(Using a continuous exposure/treatment intensity measure)

Panel A: Impact of the Michigan School Finance Reform on Components of Total Current Expenditure

	Instructional Exp. Share (%)		Support Services Share (%)		Other Elem./Sec. Exp. Share (%)	
	(1)	(2)	(3)	(4)	(5)	(6)
Reform	3.288	2.735	0.064	0.531	-0.755	-0.780
	(3.945)	(3.846)	(2.518)	(2.490)	(0.639)	(0.652)
Reform * Trend	0.532	0.476	1.430*	1.461*	-0.096	-0.117
	(1.183)	(1.158)	(0.762)	(0.760)	(0.191)	(0.194)
Ratio * Reform	0.739	0.325	0.030	0.461	0.439	0.440
	(3.737)	(3.657)	(2.436)	(2.427)	(0.587)	(0.600)
Ratio * Reform * Trend	0.086	0.089	-0.750	-0.704	0.017	0.015
	(1.126)	(1.105)	(0.738)	(0.740)	(0.176)	(0.179)
Number of Observations	4708	4699	4708	4699	4708	4699
R-squared	0.486	0.447	0.613	0.607	0.586	0.576

Panel B: Impact of the Michigan School Finance Reform on Components of Total Support Service Expenditure

	Pupil Support Share (%)		Instructional Staff Support Share (%)		General Admin. Support Share (%)	
	(7)	(8)	(9)	(10)	(11)	(12)
Reform	-0.578	-0.337	-0.905	-0.933	-0.492*	-0.506*
	(0.780)	(0.697)	(0.612)	(0.608)	(0.292)	(0.291)
Reform * Trend	-0.244	-0.226	-0.174	-0.176	-0.166*	-0.176*
	(0.261)	(0.249)	(0.215)	(0.210)	(0.095)	(0.094)
Ratio * Reform	-0.417	-0.213	-0.041	-0.091	0.187	0.184
	(0.730)	(0.655)	(0.538)	(0.530)	(0.277)	(0.277)
Ratio * Reform * Trend	-0.266	-0.250	-0.116	-0.129	0.078	0.077
	(0.235)	(0.223)	(0.192)	(0.187)	(0.091)	(0.091)
Number of Observations	4708	4699	4708	4699	4708	4699
R-squared	0.809	0.844	0.786	0.779	0.837	0.821

Panel C: Impact of the Michigan School Finance Reform on Components of Total Support Service Expenditure (continued)

	School Admin. Support Share (%)		Op./Maintenance Support Share (%)		Business Support Share (%)	
	(13)	(14)	(15)	(16)	(17)	(18)
Reform	-0.328	-0.169	-0.941*	-0.848	-0.295	-0.366
	(0.651)	(0.600)	(0.533)	(0.528)	(0.323)	(0.311)
Reform * Trend	-0.219	-0.205	0.107	0.091	0.181***	0.166***
	(0.217)	(0.205)	(0.066)	(0.064)	(0.034)	(0.035)
Ratio * Reform	-0.576	-0.436	0.171	0.231	0.299	0.275
	(0.585)	(0.537)	(0.514)	(0.512)	(0.304)	(0.298)
Ratio * Reform * Trend	-0.277	-0.260	-0.165***	-0.175***	-0.150***	-0.156***
	(0.190)	(0.179)	(0.063)	(0.064)	(0.036)	(0.034)
Number of Observations	4708	4699	4185	4177	4185	4177
R-squared	0.639	0.589	0.730	0.680	0.720	0.705

*, **, ***: significant at the 10, 5, and 1 percent levels respectively. Odd numbered columns include all 524 school districts. Even numbered columns exclude Detroit, which is the largest district in the state (accounting for about 10% of the total number of students in the state). Results are obtained from estimation of model 4. Shares relate to percentages of total expenditure. Ratio denotes the ratio of district$_i$ spending to mean spending in the immediate pre-reform year, 1994. All regressions are weighted by district enrollment, include district fixed effects, and control for enrollment and ethnicity.

Table 8: Were there Differential Changes in Private School Enrollment?
(Michigan School Districts, 1990 and 2000 Censuses)

	(1)	(2)
Year 2000 Dummy	0.12	0.12
	(0.48)	(0.48)
Group 1 * Yr 2000	0.76	0.76
	(0.58)	(0.58)
Group 2 * Yr 2000	-0.28	-0.28
	(0.65)	(0.65)
Group 4 * Yr 2000	-0.73	-0.49
	(1.01)	(0.66)
Group 5 * Yr 2000	-0.87	-0.87
	(0.66)	(0.66)
R-squared	0.92	0.92
Observations	1038	1036
Districts	519	518
Weighted	Y	Y
Exclude Detroit	N	Y

*, **, ***: significant at the 10, 5, and 1 percent levels respectively. The dependent variable is the percentage of enrolled students in a school district who attends private schools. Group 3, the middle quintile of districts in the pre-reform expenditure distribution, is the omitted category. The regressions are weighted by the enrollment of the district. Robust standard errors are in parentheses.

Table 9: Was there Differential Private School Entry?

Dependent Variable = Number of Private Schools		
	(1)	(2)
Group 1 * reform	0.31	0.23
	(0.39)	(0.37)
Group 2 * reform	0.24	0.30
	(0.38)	(0.35)
Group 4 * reform	3.36	-0.50
	(3.85)	(0.81)
Group 5 * reform	0.34	0.26
	(0.49)	(0.46)
Group 1 * reform * trend	0.03	0.02
	(0.12)	(0.12)
Group 2 * reform * trend	0.06	0.12
	(0.12)	(0.11)
Group 4 * reform * trend	-2.00**	-0.21
	(0.83)	(0.24)
Group 5 * reform * trend	-0.27	-0.21
	(0.19)	(0.15)
Observations	3126	3120
R-squared	0.99	0.96

*, **, ***: significant at the 10, 5, and 1 percent levels respectively. This table uses private school location data obtained from the private school surveys of the Common Core of Data, NCES. The private school addresses were geocoded using ArcGIS. This map was overlaid on a Michigan school district map obtained from the Census and the number of private schools in each polygon (school district) was counted using ArcGIS. Column marked (1) includes all 524 school districts, while column marked (2) excludes Detroit, which is the largest district in the state (accounting for about 10% of the total number of students in the state). The table reports results corresponding to model 2 (with group 3 omitted) where the dependent variable is number of private schools. All regressions are weighted by district enrollment, include district fixed effects, and control for enrollment and ethnicity.

Table 10: Assessing the Role of the Decline in Manufacturing Industry as a Potential Confounding Factor
(Michigan School Districts, 1980, 1990 and 2000 censuses)

	% Employed in Manufacturing	
	(1)	(2)
Trend(t)	-4.93***	-5.13***
	(0.44)	(0.53)
Reform * t	2.09***	2.62***
	(0.68)	(0.77)
Group 1 * t	1.91***	1.39*
	(0.61)	(0.76)
Group 2 * t	1.07*	1.13
	(0.61)	(0.70)
Group 4 * t	-0.16	-1.55**
	(0.60)	(0.74)
Group 5 * t	-0.36	-1.11
	(0.65)	(0.77)
Group 1 * reform * t	-0.65	-0.85
	(0.93)	(1.11)
Group 2 * reform * t	-0.72	-1.24
	(0.95)	(1.05)
Group 4 * reform * t	0.10	1.74
	(0.92)	(1.06)
Group 5 * reform * t	0.62	1.24
	(1.01)	(1.10)
Number of Observations	1558	1555
R-squared	0.919	0.929
Weighted	No	Yes

*, **, ***: significant at the 10, 5, and 1 percent levels respectively. The dependent variable is the percentage of workforce in a school district employed in manufacturing. Group 3, the middle quintile of districts in the pre-reform expenditure distribution, is the omitted category. The regression in column (2) is weighted by the enrollment of the district. Robust standard errors are in parentheses.

Table A1: Impact of Michigan School Finance Reform on Components of Total Current Expenditure
(Shares expressed as percentages of total current expenditures)

	Instructional Share (%)		Support Services Exp. Share (%)		Other Elem/Sec Exp. Share (%)	
	(1)	(2)	(3)	(4)	(5)	(6)
Group 1 * reform	0.758	0.744	-0.216	-0.207	-0.542*	-0.537*
	(0.643)	(0.643)	(0.561)	(0.562)	(0.282)	(0.281)
Group 2 * reform	1.219**	1.206**	-0.418	-0.409	-0.801***	-0.797***
	(0.581)	(0.585)	(0.596)	(0.598)	(0.292)	(0.295)
Group 3 * reform	0.833	0.832	0.334	0.333	-1.167**	-1.165**
	(0.671)	(0.669)	(0.622)	(0.622)	(0.482)	(0.482)
Group 4 * reform	4.152*	1.276	-3.791	-0.830	-0.361	-0.446
	(2.330)	(0.843)	(2.590)	(0.868)	(0.612)	(0.667)
Group 5 * reform	1.297**	1.225**	-1.099*	-1.075*	-0.199	-0.150
	(0.576)	(0.560)	(0.632)	(0.643)	(0.538)	(0.511)
Group 1 * reform * t	-1.004***	-1.001***	1.091***	1.094***	-0.087	-0.092
	(0.193)	(0.193)	(0.167)	(0.167)	(0.088)	(0.088)
Group 2 * reform * t	-0.832***	-0.831***	0.993***	0.995***	-0.161*	-0.164*
	(0.196)	(0.198)	(0.201)	(0.202)	(0.093)	(0.094)
Group 3 * reform * t	-0.723***	-0.721***	0.934***	0.934***	-0.211	-0.213
	(0.216)	(0.216)	(0.198)	(0.199)	(0.138)	(0.139)
Group 4 * reform * t	-0.117	-0.232	0.155	0.362	-0.037	-0.130
	(0.627)	(0.254)	(0.725)	(0.257)	(0.179)	(0.197)
Group 5 * reform * t	-0.608***	-0.648***	0.739***	0.756***	-0.131	-0.108
	(0.195)	(0.189)	(0.211)	(0.214)	(0.156)	(0.143)
Number of observations	4708	4699	4708	4699	4708	4699
R-squared	0.810	0.826	0.827	0.853	0.613	0.596

*, **, ***: significant at the 10, 5, and 1 percent levels respectively. †, ††, †††: Group 5 coefficients statistically different from other group coefficients at 10, 5, and 1 percent levels respectively. Odd numbered columns include all 524 school districts. Even numbered columns exclude Detroit, which is the largest district in the state (accounting for about 10% of the total number of students in the state). Results are obtained from estimation of model 3. All regressions are weighted by district enrollment, include district fixed effects, and control for enrollment and ethnicity.

Table A2: Impact of Michigan School Finance Reform on Components of Total Support Service Expenditure
(Shares expressed as percentages of Total Current Expenditures)

	Pupil Support Share (%)		Instructional Staff Support Share (%)		General Admin. Support Share (%)		School Admin. Support Share (%)		Op./Maintenance Support Share (%)		Business Support Share (%)	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Group 1 * reform	-0.352††	-0.346††	-0.786***	-0.793***	-0.486***	-0.483***	-0.861**	-0.859**	-0.826***	-0.836***	-0.320**	-0.320**
	(0.214)	(0.212)	(0.224)	(0.221)	(0.157)	(0.156)	(0.369)	(0.368)	(0.240)	(0.239)	(0.131)	(0.130)
Group 2 * reform	-0.494*†	-0.487*†	-1.157***	-1.161***	-0.500***	-0.498***	-0.648***†	-0.645***†	-1.162***	-1.173***	-0.343	-0.343
	(0.271)	(0.270)	(0.242)	(0.244)	(0.177)	(0.177)	(0.243)	(0.243)	(0.159)	(0.158)	(0.220)	(0.220)
Group 3 * reform	-0.524	-0.522	-0.817***	-0.817***	-0.676***	-0.675***	-0.888***	-0.887***	-0.768***	-0.777***	-0.265**	-0.267**
	(0.367)	(0.369)	(0.210)	(0.214)	(0.159)	(0.158)	(0.137)	(0.136)	(0.120)	(0.121)	(0.135)	(0.135)
Group 4 * reform	-2.580	-1.235**	-1.537**	-1.989***	-0.275**	-0.317**	-1.983**	-0.983**	-1.398***	-0.831***	0.249	-0.013
	(1.695)	(0.574)	(0.598)	(0.771)	(0.117)	(0.146)	(1.006)	(0.433)	(0.457)	(0.166)	(0.418)	(0.210)
Group 5 * reform	-1.240***	-1.244***	-1.361***	-1.404***	-0.385**	-0.365*	-1.203***	-1.206***	-1.026***	-1.048***	-0.186	-0.191
	(0.318)	(0.322)	(0.314)	(0.328)	(0.192)	(0.196)	(0.207)	(0.207)	(0.200)	(0.198)	(0.180)	(0.178)
Group 1 * reform * t	-0.319***††	-0.313***††	-0.135*	-0.131*	-0.096*	-0.097*	-0.418***	-0.415***	0.042*	0.043**	0.063***†††	0.061***†††
	(0.068)	(0.066)	(0.070)	(0.069)	(0.051)	(0.051)	(0.099)	(0.099)	(0.022)	(0.022)	(0.014)	(0.014)
Group 2 * reform * t	-0.444***	-0.439***	-0.168**	-0.166**	-0.179***	-0.180***	-0.440***	-0.438***	0.055***†	0.052***††	0.078***†††	0.077***†††
	(0.091)	(0.090)	(0.073)	(0.073)	(0.052)	(0.052)	(0.080)	(0.079)	(0.020)	(0.020)	(0.022)	(0.022)
Group 3 * reform * t	-0.318***††	-0.314***†	-0.192***	-0.190***	-0.199***	-0.199***	-0.554***	-0.553***	0.002	-0.001	0.095***†††	0.091***†††
	(0.118)	(0.119)	(0.066)	(0.068)	(0.049)	(0.049)	(0.044)	(0.044)	(0.016)	(0.016)	(0.019)	(0.018)
Group 4 * reform * t	-0.870	-0.791***	-0.537***	-0.666***	-0.035	-0.060	-0.737**	-0.648***	0.069	-0.029	0.121**†††	0.030†
	(0.559)	(0.258)	(0.198)	(0.243)	(0.039)	(0.051)	(0.318)	(0.202)	(0.079)	(0.020)	(0.053)	(0.025)
Group 5 * reform * t	-0.635***	-0.626***	-0.295***	-0.316***	-0.105	-0.094	-0.588***	-0.586***	0.003	-0.009	-0.014	-0.026
	(0.108)	(0.111)	(0.113)	(0.118)	(0.066)	(0.067)	(0.083)	(0.084)	(0.023)	(0.023)	(0.023)	(0.020)
Number of observations	4708	4699	4708	4699	4708	4699	4708	4699	4185	4177	4185	4177
R-squared	0.852	0.883	0.817	0.808	0.872	0.858	0.701	0.702	0.837	0.827	0.731	0.723

*, **, ***: significant at the 10, 5, and 1 percent levels respectively. †, ††, †††: Group 5 coefficients statistically different from other group coefficients at 10, 5, and 1 percent levels respectively. Odd numbered columns include all 524 school districts. Even numbered columns exclude Detroit, which is the largest district in the state (accounting for about 10% of the total number of students in the state). Results are obtained from estimation of model 3. All regressions are weighted by district enrollment, include district fixed effects, and control for enrollment and ethnicity.

Table A3: Impact of the Michigan School Finance Reform on Resource Allocation
(Using Percentage of Total Current Expenditure and a continuous exposure/treatment intensity measure)

Panel A	Pupil Support Share (%)		Instructional Staff Support Share (%)		General Admin. Support Share (%)	
	(1)	(2)	(3)	(4)	(5)	(6)
Reform	-0.422	-0.155	-1.076	-1.108	-0.600*	-0.618**
	(0.855)	(0.735)	(0.694)	(0.696)	(0.319)	(0.314)
Reform * Trend	-0.372	-0.349	-0.300	-0.300	-0.226**	-0.237**
	(0.291)	(0.272)	(0.251)	(0.246)	(0.104)	(0.102)
Ratio * Reform	-0.930	-0.715	-0.179	-0.242	0.176	0.173
	(0.794)	(0.683)	(0.610)	(0.609)	(0.307)	(0.304)
Ratio * Reform * Trend	-0.215	-0.201	-0.030	-0.048	0.119	0.118
	(0.260)	(0.242)	(0.226)	(0.223)	(0.101)	(0.100)
Number of Observations	4708	4699	4708	4699	4708	4699
R-squared	0.845	0.881	0.814	0.805	0.871	0.857

Panel B	School Admin. Support Share		Op./Maintenance Support Share		Business Support Share	
	(7)	(8)	(9)	(10)	(11)	(12)
Reform	-0.539	-0.354	-0.915***	-0.786**	-0.449	-0.520
	(0.612)	(0.517)	(0.316)	(0.305)	(0.353)	(0.344)
Reform * Trend	-0.355*	-0.336*	0.077	0.073	0.210***	0.198***
	(0.216)	(0.194)	(0.048)	(0.045)	(0.037)	(0.038)
Ratio * Reform	-0.735	-0.584	-0.177	-0.137	0.348	0.313
	(0.538)	(0.444)	(0.292)	(0.286)	(0.330)	(0.328)
Ratio * Reform * Trend	-0.221	-0.208	-0.138***	-0.164***	-0.142***	-0.153***
	(0.186)	(0.163)	(0.045)	(0.045)	(0.040)	(0.038)
Number of Observations	4708	4699	4185	4177	4185	4177
R-squared	0.690	0.699	0.835	0.827	0.723	0.722

*, **, ***: significant at the 10, 5, and 1 percent levels respectively. Odd numbered columns include all 524 school districts. Even numbered columns exclude Detroit, which is the largest district in the state (accounting for about 10% of the total number of students in the state). Results are obtained from estimation of model 4 with the above variables as dependent variables. Ratio denotes the ratio of district$_i$ spending to mean spending in the immediate pre-reform year, 1994. All regressions are weighted by district enrollment, include district fixed effects, and control for enrollment and ethnicity.

Table A4: Impact of Michigan School Finance Reform on Components of Total Current Expenditures, after Controlling for Private School and Charter School Presence

	Pupil Support Share (%)		Instructional Staff Support Share (%)		General Admin. Support Share (%)		School Admin. Support Share (%)		Op./Maintenance Support Share (%)		Business Support Share (%)	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Group 1 * reform	-0.28	-0.27	-0.59***	-0.59***	-0.37**	-0.36**	-0.60	-0.59	-0.69**†	-0.69**†	-0.28*	-0.26
	(0.22)	(0.21)	(0.21)	(0.21)	(0.17)	(0.17)	(0.39)	(0.39)	(0.32)	(0.32)	(0.17)	(0.16)
Group 2 * reform	-0.35	-0.33	-1.13***	-1.14***	-0.38**	-0.37**	-0.30	-0.28	-0.69**†	-0.69**†	-0.30	-0.28
	(0.28)	(0.28)	(0.23)	(0.23)	(0.18)	(0.18)	(0.27)	(0.27)	(0.31)	(0.31)	(0.21)	(0.21)
Group 3 * reform	-0.26	-0.23	-0.57***	-0.58***	-0.57***	-0.57***†	-0.55**	-0.54**	-0.58*	-0.57*	-0.35**	-0.32**
	(0.32)	(0.32)	(0.20)	(0.20)	(0.17)	(0.17)	(0.27)	(0.26)	(0.31)	(0.31)	(0.15)	(0.15)
Group 4 * reform	-0.52	-0.63	-1.21**	-1.58**	-0.16	-0.17	-0.61**	-0.61*	-0.13	-0.13	0.06	0.10
	(0.45)	(0.57)	(0.61)	(0.72)	(0.11)	(0.14)	(0.30)	(0.36)	(0.25)	(0.26)	(0.27)	(0.26)
Group 5 * reform	-0.63*	-0.51	-0.72**	-0.76**	-0.19	-0.16	-0.62**	-0.57**	0.05	0.08	-0.25	-0.19
	(0.34)	(0.33)	(0.30)	(0.30)	(0.17)	(0.17)	(0.25)	(0.25)	(0.31)	(0.32)	(0.19)	(0.19)
Group 1 * reform * t	-0.31***††	-0.30***†††	-0.15**	-0.14**	-0.08	-0.09	-0.37***	-0.37***†	-0.02†††	-0.02†††	0.05*†	0.04
	(0.07)	(0.06)	(0.07)	(0.07)	(0.05)	(0.05)	(0.11)	(0.11)	(0.06)	(0.06)	(0.03)	(0.03)
Group 2 * reform * t	-0.37***†	-0.37***†	-0.12*	-0.11*†	-0.13**	-0.13**	-0.40***	-0.41***†	-0.05††	-0.05††	0.05†	0.05
	(0.09)	(0.09)	(0.06)	(0.07)	(0.05)	(0.05)	(0.08)	(0.08)	(0.06)	(0.06)	(0.04)	(0.03)
Group 3 * reform * t	-0.27***††	-0.26***††	-0.13**	-0.13**	-0.17***	-0.18***	-0.45***	-0.46***	-0.06††	-0.07††	0.09***†††	0.09***††
	(0.10)	(0.10)	(0.06)	(0.06)	(0.05)	(0.05)	(0.07)	(0.07)	(0.05)	(0.05)	(0.03)	(0.03)
Group 4 * reform * t	-0.70***	-0.79***	-0.49***	-0.60***	-0.05	-0.07	-0.63***	-0.63***	-0.23***	-0.24***	-0.03	-0.03
	(0.18)	(0.22)	(0.18)	(0.22)	(0.03)	(0.04)	(0.12)	(0.15)	(0.05)	(0.05)	(0.04)	(0.04)
Group 5 * reform * t	-0.61***	-0.63***	-0.30***	-0.31***	-0.10**	-0.11**	-0.57***	-0.63***	-0.25***	-0.26***	-0.04	-0.02
	(0.11)	(0.11)	(0.10)	(0.10)	(0.05)	(0.05)	(0.09)	(0.08)	(0.06)	(0.06)	(0.03)	(0.04)
Number of observations	2616	2611	2616	2611	2616	2611	2616	2611	2093	2089	2093	2089
R-squared	0.840	0.841	0.772	0.766	0.842	0.824	0.691	0.609	0.771	0.710	0.747	0.703

*, **, ***: significant at the 10, 5, and 1 percent levels respectively. †, ††, †††: Group 5 coefficients statistically different from other group coefficients at 10, 5, and 1 percent levels respectively. Odd numbered columns include all 524 school districts. Even numbered columns exclude Detroit, which is the largest district in the state (accounting for about 10% of the total number of students in the state). Results are obtained from estimation of model 3. Shares relate to percentages of total expenditure. All regressions are weighted by district enrollment, include district fixed effects, and control for enrollment, ethnicity, number of private schools, and number of charter schools in districts.

Table A5: Impact of the Michigan School Finance Reform on Resource Allocation, after Controlling for Private School and Charter School Presence

(Using a continuous exposure/treatment intensity measure)

Panel A: Impact of the Michigan School Finance Reform on Components of Total Support Service Expenditure

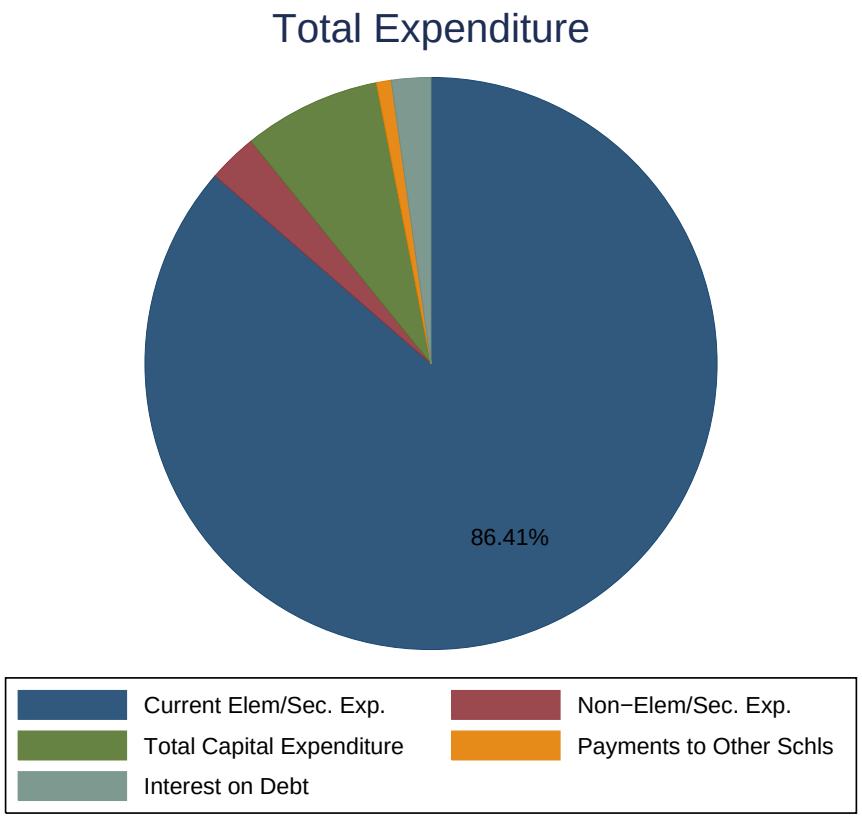
	Pupil Support Share (%)		Instructional Staff Support Share (%)		General Admin. Share (%)	
	(7)	(8)	(9)	(10)	(11)	(12)
Reform	-0.412	-0.422	-1.323*	-1.353*	-0.572*	-0.582*
	(0.744)	(0.745)	(0.712)	(0.699)	(0.298)	(0.297)
Reform * Trend	-0.178	-0.147	-0.149	-0.145	-0.147	-0.151
	(0.257)	(0.239)	(0.234)	(0.222)	(0.093)	(0.093)
Ratio * Reform	-0.084	-0.029	0.384	0.336	0.281	0.282
	(0.706)	(0.702)	(0.641)	(0.625)	(0.279)	(0.279)
Ratio * Reform * Trend	-0.329	-0.371*	-0.140	-0.160	0.053	0.045
	(0.230)	(0.220)	(0.210)	(0.200)	(0.088)	(0.089)
Number of Observations	2616	2611	2616	2611	2616	2611
R-squared	0.838	0.838	0.768	0.761	0.841	0.823

Panel B: Impact of the Michigan School Finance Reform on Components of Total Support Service Expenditure (cont.)

	School Admin. Support Share (%)		Op./Maintenance Support Share (%)		Business Supp. Share (%)	
	(13)	(14)	(15)	(16)	(17)	(18)
Reform	-0.272	-0.281	-1.359*	-1.361*	-0.443	-0.546
	(0.642)	(0.626)	(0.700)	(0.698)	(0.385)	(0.384)
Reform * Trend	-0.202	-0.133	0.195	0.206	0.198***	0.178**
	(0.212)	(0.195)	(0.132)	(0.130)	(0.069)	(0.071)
Ratio * Reform	-0.287	-0.246	1.006	1.012	0.237	0.371
	(0.589)	(0.576)	(0.678)	(0.680)	(0.370)	(0.374)
Ratio * Reform * Trend	-0.304	-0.378**	-0.323**	-0.340***	-0.177***	-0.155**
	(0.189)	(0.178)	(0.130)	(0.128)	(0.066)	(0.068)
Number of Observations	2616	2611	2093	2089	2093	2089
R-squared	0.690	0.606	0.770	0.708	0.746	0.702

*, **, ***: significant at the 10, 5, and 1 percent levels respectively. Odd numbered columns include all 524 school districts Even numbered columns exclude Detroit, which is the largest district in the state (accounting for about 10% of the total number of students in the state). Results are obtained from estimation of model 4. Shares relate to percentages of total expenditure. Ratio denotes the ratio of district$_i$ spending to mean spending in the immediate pre-reform year, 1994. All regressions are weighted by district enrollment, include district fixed effects, and control for enrollment, ethnicity, number of private schools, and number of charter schools in districts.

Figure 1: Composition of Total Expenditure and Total Current Expenditure in the pre-reform period



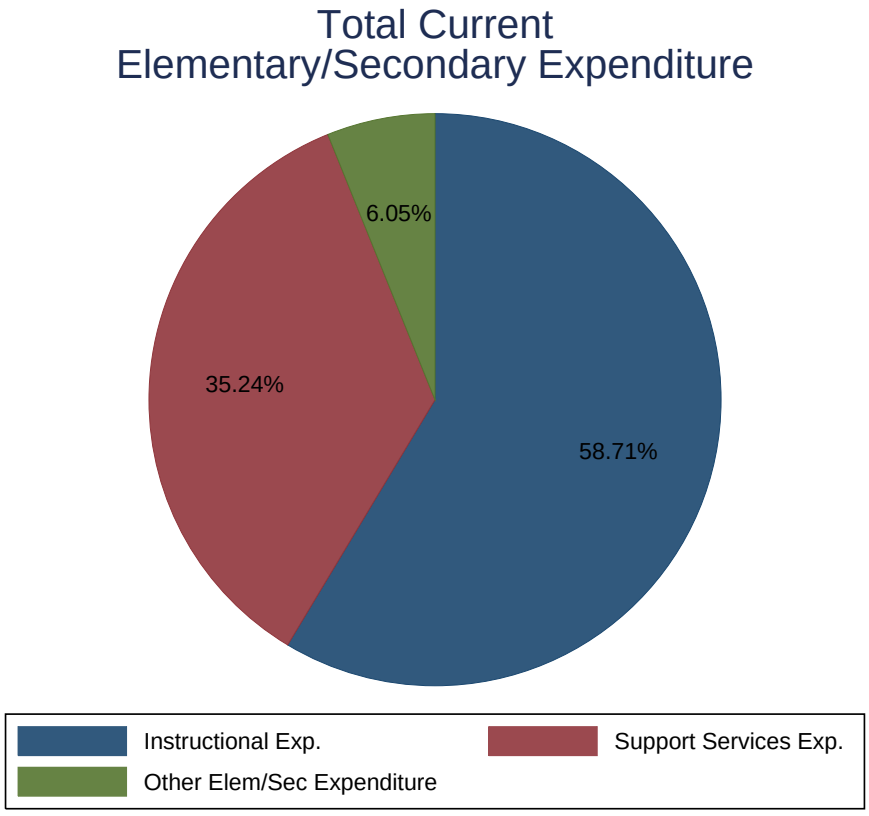
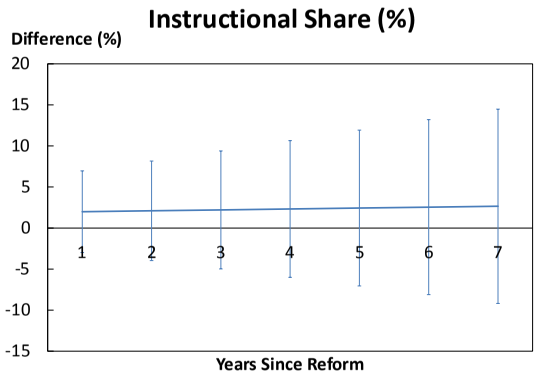
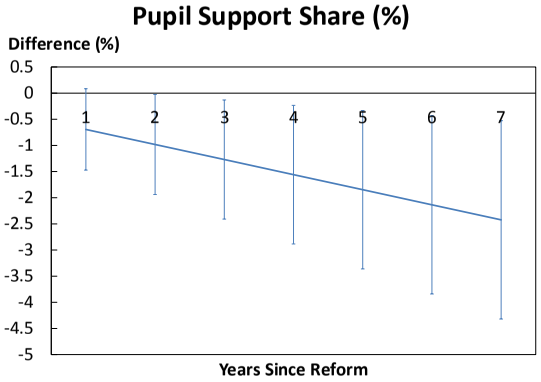


Figure 2: Difference (Group5 - Group1) in Total Treatment Effects



(A)



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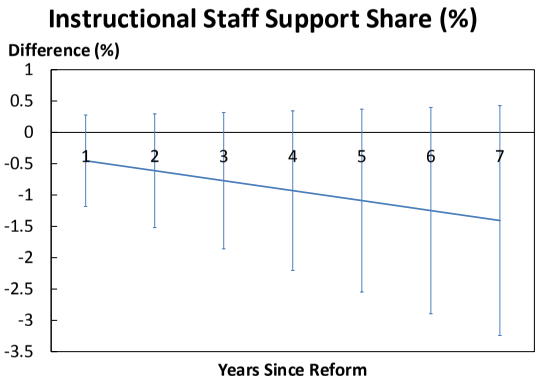

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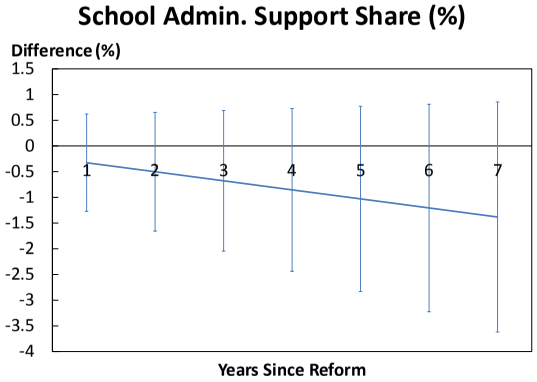

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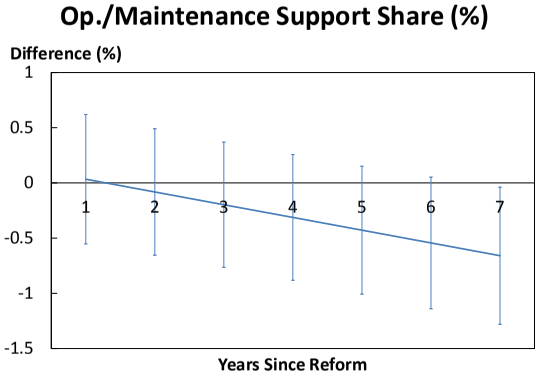
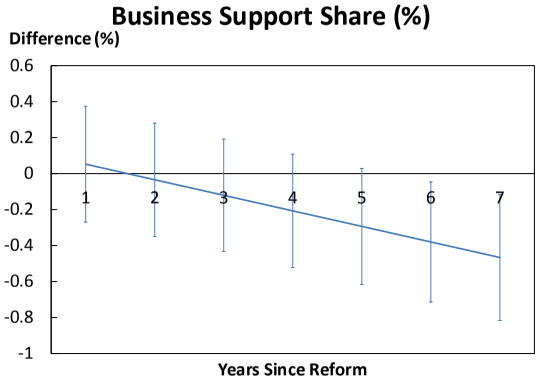


(E)

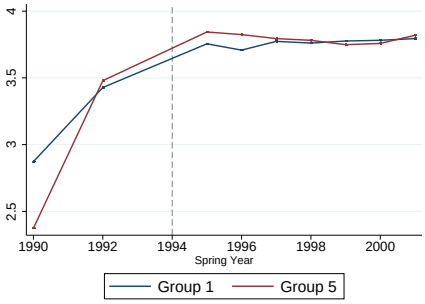


(F)

Difference in total treatment effects between Groups 5 and 1 and 90% confidence interval bars shown.

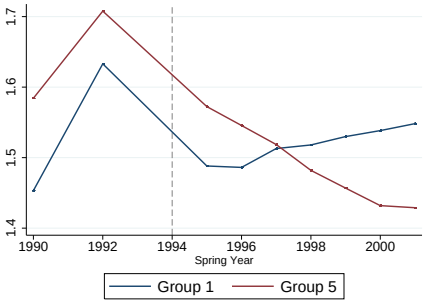
Figure 3: Impact of the Michigan School Finance Reform on Resource Allocation on Groups 1 and 5

(Predicted Value Plots for Groups 1 and 5 Using Specification (3))

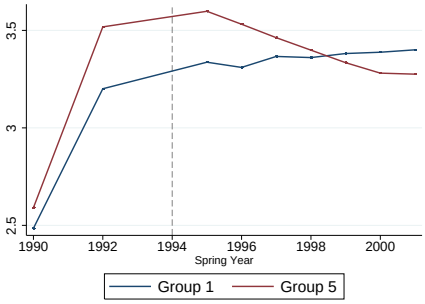


(A) Share of Pupil Support Services Expenditure

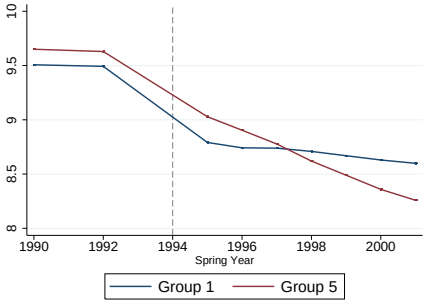
(B) Share of Instructional Staff Support Expenditure



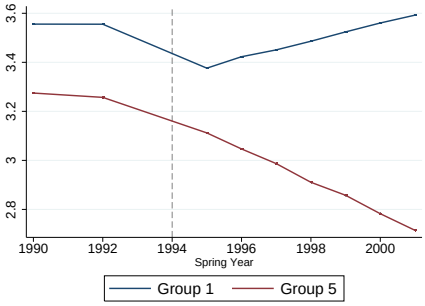
(C) Share of General Administrative Support Expenditure



(D) Share of School Administrative Support Expenditure



(E) Share of Operational and Maintenance Support Expenditure



(F) Share of Business Support Expenditure

Figure 4: Impact of the Michigan School Finance Reform on Resource Allocation

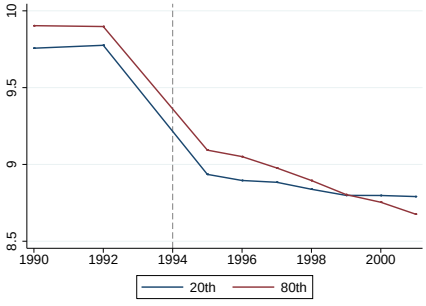
(Predicted Value Plots for the 20th and 80th Percentiles of "Ratio" Using Specification (4))

(A) Share of Pupil Support Services Expenditure

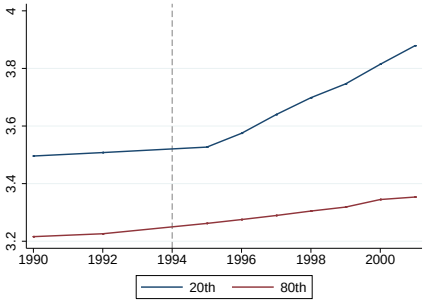
(B) Share of Instructional Staff Support Expenditure

(C) Share of General Administrative Support Expenditure

(D) Share of School Administrative Support Expenditure



(E) Share of Operational and Maintenance Support Expenditure



(F) Share of Business Support Expenditure