# Housing Markets and Residential Segregation: Impacts of the Michigan School Finance Reform on Inter- and Intra-district Sorting

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**Abstract**

Local financing of public schools in the U.S. leads to a bundling of two distinct choices – residential choice and school choice – and has been argued to increase the degree of socioeconomic segregation across school districts. A school finance reform, aimed at equalization of school finances, can in principle weaken this link between housing choice and choice of schools. In this paper, we study the impacts of the Michigan school finance reform of 1994 (Proposal A) on spatial segregation. The reform was a state initiative intended to equalize per pupil expenditures between Michigan school districts and reduce the role of local financing. We find that Proposal A led to a decline in neighborhood sorting within education markets, as measured by changes in the value of housing stock and several socioeconomic indicators. We also find that the reform affected dispersion of incomes and educational attainment within school districts, increasing within-district heterogeneity in the lowest spending school districts, while decreasing the same in the highest spending districts. However, there is continued high demand for residence in the highest spending communities. These findings are robust to various alternative definitions of "education market", and survive several sensitivity checks. These spatial segregation patterns are not replicated in neighboring Ohio that did not face similar school finance equalization.

**Keywords:** Spatial segregation, School finance reform, Tiebout sorting, Peer effects
**JEL Classifications:** H4, I2, R2

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# 1 Introduction

Local financing of public schools is one of the distinguishing features of the K-12 educational system in the U.S. A substantial share of the total funds for educational expenditures is raised at the local school district level, primarily by taxes levied on property. This leads to a bundling of two distinct choices – residential choice and school choice. Parents in the U.S. often choose their residences on the basis of the quality of schools in the locality. Since, as is often argued, demand for (and affordability of) a good education increases with parental income and educational attainment, this can potentially lead to economic and demographic segregation across school districts within a state. A school finance reform, loosely interpreted as an equalization of school finances within state boundaries, can in principle weaken this link between housing choice and choice of schools. It can dilute the extent of socioeconomic stratification and affect house prices and property values. In this paper, we study the effect of the Michigan school finance reform of 1994 on spatial segregation. We investigate whether the reform had any significant effects on values of housing stock and socioeconomic compositions of districts, thereby affecting residential sorting in the state. In the process, we provide evidence on the effectiveness of a comprehensive community-based government aid program in significantly affecting spatial segregation.

In 1994, the state of Michigan embarked on a comprehensive overhaul of its school finance program, when it enacted a new plan called Proposal A. This reform significantly increased the state share of K-12 revenues and included giving large sums of money to the lowest spending districts, which were also allowed to increase their future spending at a much faster rate than others. Concurrently, Proposal A also ended local discretion over school spending. Based on spending by individual districts in 1993-94, the last year before the program, the state now decided the amount by which each district could raise its subsequent expenditures. The highest spending districts in the state were held harmless, that is, they did not witness any actual decline in per pupil expenditures, but were constrained in future increases. Over time, the gap in spending was significantly reduced. Also, there is evidence (Papke, 2005; Papke, 2008; Roy, 2011) that the reform led to significant gains in academic performance in the lowest spending districts and the gap in educational outcomes between the highest and lowest spending districts narrowed. This relative equalization sets the stage for studying the impacts on socio-economic segregation. If there was no impact on educational outcomes, then a study of the impact on socio-economic segregation would be largely moot – a priori there would not be much of a case in favor of reductions in socio-economic segregation. However, the increased attractiveness of the low spending districts and the narrowing of the educational gap have made an analysis of the impact on

socio-economic segregation interesting and relevant. It is instructive to examine whether a reduction in educational disparities brought about by the school finance reform translated into a reduction in socio-economic segregation.

We start by defining an "education market"[1] – an area that is reasonably self-contained, shares strong social and economic ties, and where residents typically share the same set of school and residential options – and study sorting patterns within these education markets.[2] Using data from 1990 to 2001 (which straddle 1994, the year of the reform), and a difference-in-differences estimation strategy in trends, we find that there was a positive effect of the school finance reform on the values of housing stock in the lowest spending school districts. But the results also suggest continued high demand for residence in the highest spending school districts. We then use data from three decennial U.S. censuses (1980, 1990 and 2000) to study the evolution of different measures of socioeconomic indicators – particularly income, education, housing occupancy and ownership measures, and employment variables – across different Michigan districts in the pre- and post-reform periods. Our results reveal consistent evidence of reduction in socio-economic segregation within education markets in the post-reform period. We also undertake an analysis of within-district dispersions of measures of socioeconomic status. We find that the reform increased within-district heterogeneity of incomes and educational attainment in the lowest spending school districts, while decreasing the same in the highest spending districts. These findings are robust to various alternative definitions of "education market", and survive several sensitivity checks. Of note is that this finding of decreased residential sorting is not replicated in neighboring Ohio that did not face such school finance equalization.

This study is related most closely to the strand of literature that studies residential locations of households, stemming from the classic work of Tiebout (1956). Tiebout (1956) hypothesized that if households are free to choose where to reside among many competing jurisdictions, this would ensure efficiency in the provision of 'local' public services. This is because households would vote 'with their feet' if not satisfied with the existing level and cost of these services. A rich literature estimates the marginal willingness of households to pay for school quality – the general conclusion is that parents are willing to pay a substantial price for schools considered 'desirable' (Black (1999), Barrow (2002), Figlio and Lucas (2004)). While studies have also analyzed the effect of school finance reforms on resource equalization and academic performance (Papke (2005), Roy (2011), Cullen and Loeb (2004)), to date

[1] A rich literature uses "education markets". See for example, Bayer and Mcmillan (2005), Bayer and Mcmillan (2012), Epple and Sieg (1999), Epple and Ferreyra (2008), Ferreyra (2007), Ferreyra (2009).

[2] We use various definitions of "education market" in this paper: (i) metropolitan statistical areas (MSA) (ii) metropolitan statistical areas and micropolitan statistical areas (mSA), that is, core based statistical areas (CBSA) (iii) area within certain reasonable radii from centroids of CBSAs and (iv) counties. For more details, see section 5.1.

there have been few systematic empirical evaluations of the impact of these programs on socioeconomic segregation.

In two valuable contributions, Epple and Ferreyra (2008) and Ferreyra (2009) examine the general equilibrium effects of Proposal A on housing prices and neighborhood composition in the Detroit metropolitan area. They find a limited impact of the school finance reform – some effect on housing prices, but little on neighborhood demographics, unlike in this study. The lack of significant impacts may be due to their focus on Detroit, which was relatively less affected by the spending equalization due to Proposal A. This study covers the universe of Michigan school districts, and hence also includes districts that were significantly affected by Proposal A – the purpose of this paper is to compare the experiences of districts lying at different points of the pre-program spending distribution within education markets.

This paper is most closely related to Aaronson (1999) and Dee (2000). Using data on all U.S. school districts from 1980 and 1990 censuses, Aaronson (1999) studies whether school finance reforms alter income heterogeneity within school districts. He finds that the poorest and lowest spending districts in states with *court-mandated* school finance systems became significantly more diversified in the post reform period. Dee (2000) uses decennial census data through 1990 to look at whether in states with *court-mandated* school finance reforms, the new expenditures on schools have been capitalized into housing values and residential rents. He finds that such reforms increased median housing values and rents in the districts receiving state aid. While the present paper has been informed by these studies and builds on them, it differs in some fundamental ways. It studies residential sorting within "education markets" where Tiebout type sorting is best facilitated; focuses on the impact of one reform in one state and hence is immune to the sensitivity associated with different methods of classification of states into reform and non-reform states (Aaronson (1999) and Hoxby (2001)); controls for pre-existing differences in trends and market specific heterogeneities; studies a broader range of indicators including several socio-economic variables and additional housing indicators, and also considers a more recent time period.

This is the first paper to undertake a detailed analysis of a major school finance reform on socioeconomic stratification. Michigan provides a particularly interesting case as the large number of fiscally independent school districts (524 K-12 districts) resulted in significant disparities in school spending in the pre-program period along with a high degree of residential segregation. Second, the large changes in per pupil spending and the significant constraints on local discretion happened even though the courts did not find the existing finance system unconstitutional, making Proposal A one of the more interesting school finance reforms. Third, there is substantial evidence that the reform was instrumental in sig-

nificantly improving academic performance in the lowest-spending districts (Papke, 2005; Papke, 2008; Roy, 2011). Thus the Michigan experience allows us to examine the segregation impacts of a reform that had demonstrably positive effects on performance, unlike the reforms discussed in Aaronson (1999) or Dee (2000).

# 2 The Michigan School Finance System

## 2.1 Michigan before Proposal A

The Michigan school finance reform, Proposal A, was not a response to any adverse court ruling or to a sudden rise in public concern over disparities in school spending. Rather, it was an unexpected by-product of the prevailing debate over high property taxes, whose main purpose was supporting local schools. Prior to Proposal A, Michigan had been using a district power equalizing (DPE) formula, where districts were allocated state funds based on their local property tax rates. This was intended to make the system wealth-neutral – so that high property-tax wealth in a school district does not lead to high revenues except through a higher tax rate – while leaving the choice of property tax rates to the local districts. But despite this, there were significant differences in spending across school districts. At the same time, there was a heavy reliance on local property taxes as the source of school revenues. In 1994, just before the reform, Michigan's property tax burden was the seventh highest in the country and its share of school spending financed locally (61%) was the fourth highest.[3]

## 2.2 Proposal A, the Michigan School Finance Program

In March 1994, Michigan voters overwhelmingly ratified Proposal A, which reduced the reliance of school revenues on property taxes. Most of the lost revenues were replaced by an increase in the statewide sales tax from 4% to 6%. This resulted in a large rise in the state share of K-12 spending, from 31.3% in 1993 to 77.5% in 1997.

The new school spending plan, effective from 1994-95, worked as follows. First, the 1993-94 level of spending in each district was taken as the base, and was called the district's Foundation Allowance (FA). Second, future increases in all districts' FAs were governed entirely by the state legislature – the lowest spending school districts were allowed to increase spending at much faster rates than their higher spending counterparts. Over time this led to a substantial narrowing of the spending gap across districts. Further, all districts, including the highest spending ones, were held harmless – none suffered

[3]The three states with a higher share of school expenditures financed locally in 1994 were New Hampshire (86%), Illinois (62%) and Vermont (61%).

any absolute decline in per pupil spending. However, their abilities to raise additional money for their local schools in the future, over and above the amount sanctioned by the state, were severely constrained.

Table 1 shows changes in foundation allowances in selected Michigan school districts in the post-reform period. We show seven districts located at different percentiles in the pre-reform spending distribution. The large catch-up exhibited by the lowest spending districts is immediately evident. For example, a district like Standish-Sterling Community Schools, in the bottom percentile of the spending distribution in 1994, witnessed an increase of about 61% in foundation allowances over the next 7 years. However, for Bloomfield Hills school district, already spending over $10,000 in 1994, the increase was only about 10%. Note that this narrowing of the spending gap was accomplished mostly by increasing school spending at a higher rate in the lowest spending districts.

## 3 Theoretical Background

There is a rich literature in public finance and urban economics exploring local segregation and its causes and consequences, see Ross and Yinger (1999) for a survey. So we confine ourselves to a discussion of the basic theoretical intuition behind the potential segregation effects of a school finance reform.

To first describe the pre-reform scenario, let there be two school districts, $A$ and $B$, and a continuum of households with school-age children. Households are mobile between the two school districts, that is, they can choose to reside in either school district without transportation costs featuring prominently in the decision.[4] In other words, A and B together constitute an education market. Utility of a household depends on its educational attainment and its consumption of "all other goods". The former is an increasing function of per pupil spending in the school district, peer group quality in the school district, and the household's own characteristics (parental education, household income, and tastes for education). Peer group quality is an increasing function of the average socioeconomic status (SES) of households in the school district, proxied by household incomes and education. School spending is financed by state aid and local revenue, where the latter is locally determined and locally raised (by property taxes). These tax rates on local property are determined by the median voter within each district.

[4]Here, we assume that families can migrate from one school district to another within an education market comparatively costlessly, without other considerations (job availability, closeness to family, etc.) featuring importantly in the decision.

### 3.1 Effect on *Inter-district* Stratification

Under the above circumstances, there will be stratification by SES between the two school districts. All households in one of the school districts (say school district $A$) will have SES at least as high as the household with the highest SES in school district $B$. First, households will tend to cluster together, since under local discretion over property tax rates (and hence, school spending), households will tend to choose school districts which spend the same amount of money on education that they themselves would have chosen. Since education is a normal good, higher income households demand, and can afford, higher school expenditures, resulting in segregation along income across district boundaries. Second, if peer effects have a strong positive influence on academic attainment, then higher SES households would be inclined to pay more for residences in school districts that have more favorable peer groups.

A school finance reform can be approximated in this setup as an equalization of school spending across school districts (and hence, as a transfer of resources from school district $A$ to school district $B$). In this scenario, households residing in the poorer school district $B$ will find that their school spending has gone up. This will increase the relative attractiveness of school district $B$ – some households (towards the bottom of the SES distribution in district A) who had earlier been preferring school district $A$ to school district $B$, will switch to school district $B$, where the schools are now funded at higher levels. Note that this mobility would lead to an increase in average peer group quality in both districts A and B. This, in turn, might reduce the mobility response to the school finance reform, but should not fully offset the mobility response in either district A or district B.

If the supply of housing is relatively inelastic in the poorer district $B$, then most of the increase in school spending in that district will be capitalized in an increase in house prices. Otherwise, one would expect an increase both in housing prices and in the occupation of housing units in district $B$, resulting from migration of households from district $A$. In either case, the value of total housing stock – the variable employed in the empirical analysis later – should go up in the poorer school district $B$, and we test for this in the empirical part of the paper.

### 3.2 Effect on *Intra-district* Stratification

A school finance reform also has important and interesting implications on stratification *within* school districts. When there is no change in segregation between districts, e.g. when the supply of housing is inelastic, there is no change in variance of different SES measures (like household incomes and educational attainment) within the districts themselves. Most of the adjustment in this case is likely borne by housing prices and rents. However, when there is migration of households across districts, the

poorer district $B$ receives an influx of households who are relatively richer and relatively more educated compared to its original (pre-reform) population, while the richer district $A$ loses some of its relatively poorer and relatively less educated households. This leads to an *increase* in variance of incomes and educational attainment within the poorer district $B$, and a corresponding *reduction* within the richer district $A$. So a school finance reform either leaves within-district dispersion mostly unchanged (when there is little or no inter-district migration), or increases it in the poor and low spending districts (who benefit from the reform) and decreases it in the rich and high spending districts.

Summing up, intuition from this discussion of spatial segregation leads to the following predictions relating to the effects of a school finance reform. First, the move from a locally-financed to a state-financed system would be expected to lead to a weakening of existing segregation, as the reform compresses one dimension – perhaps the most important dimension (expenditure) – along which sorting previously occurred. Second, the reform should increase within-district dispersion of SES in these low spending districts, while decreasing it in the high spending districts (unless there is little or no migration across districts).

# 4 Data

The data used in this study come from multiple sources – the Michigan Department of Education, the Common Core of Data of the National Center for Education Statistics, and the Census Bureau. School district data on revenues, expenditures, and housing stock in Michigan are obtained from the Michigan Department of Education. Housing stock refers to the value of housing stock and measures the total amount of housing wealth in a school district. The advantage of this variable is that it is able to capture both changes in house prices and changes in total stock of housing. This is useful as not all changes in housing demand may get reflected in house prices. We use annual data from 1990 to 2001, which allow us to control for differences in pre-program trends across districts. We do not use data from 2002 and beyond, since the effects of the reform in this period might be confounded with those of the introduction of the federal No Child Left Behind Act. Note though, that most of the effects of Proposal A would have likely materialized by 2001.

We also use school district level data on student achievement in the Michigan Education Assessment Program (MEAP) tests in reading and math for 1994 and 2001. These are obtained from Michigan Department of Education's K-12 database. The data for enrollment and free lunch eligibility for the school districts come from the Common Core of Data (CCD) of the National Center for Education Statistics (NCES).

In addition, we use the 1980, 1990, and 2000 censuses to obtain data on socioeconomic characteristics for Michigan and Ohio school districts. These characteristics include multiple housing related variables (percentage of housing units in a district that are occupied, percentage of owner-occupied housing units, median gross rent), measures of income and employment (median household income in the district, percentage of households with public assistance (PA) income, civilian unemployment rate), and measures of educational attainment (percentage of adults with less than 12th grade schooling, percentage with at least some college education (including a bachelor's degree), percentage with at least a bachelor's degree). The Michigan census data are used to study the impact of Proposal A on Michigan school districts.

We use neighboring Ohio, which did not have a school finance reform during this period, as the control state. Census data for Ohio are used to conduct a falsification exercise – we investigate if similar residential sorting patterns (as Michigan) are seen in Ohio even in the absence of school finance reform. We also investigate whether Michigan experienced a reduction in spatial stratification in the post-reform period *relative* to neighboring Ohio (see section 7.1 for details). In sensitivity analysis, we also use data on percentage of a school district's workforce employed in manufacturing in Michigan from the 1980, 1990, and 2000 censuses to investigate the robustness of our findings to the decline of Michigan's manufacturing sector.

# 5 Empirical Strategy

## 5.1 Defining a "Market"

We begin by defining an "education market" (Bayer and Mcmillan (2005), Bayer and Mcmillan (2012), Epple and Sieg (1999), Epple and Ferreyra (2008), Ferreyra (2007), Ferreyra (2009)) – an area that is self-contained, well integrated socially and economically, and where residents enjoy the same set of school and residential choices. A key feature of such markets is that households can choose residence and schools from several alternative communities without changing their place of employment. One can then expect such markets to facilitate Tiebout-type mobilities and sorting. And, importantly, one can reasonably expect a school finance reform to induce movements within these markets from high spending districts (that the school finance reform rendered less attractive) to low spending ones (that suddenly became more attractive under the same reform). In the empirical part of the paper, we investigate whether the school finance reform led to a decline in residential and socio-economic segregation within these education markets.

In this paper, we use various alternative formulations of "education markets" and investigate the

sensitivity of our results to these alternative market definitions. First, we start by defining metropolitan statistical areas as markets. The United States Office of Management and Budget (OMB) defines a metropolitan statistical area (MSA) as a core based statistical area having at least one urbanized area of 50,000 or more population, plus adjacent territory that has a high degree of social and economic integration with the core as measured by commuting ties. Figure 1 shows the map of MSAs in Michigan. Black lines, colors, and labels depict the MSAs. The MSA map is overlaid on school district boundaries, the latter represented by grey lines. While one can reasonably expect MSAs to serve as education markets, one potential problem is that the MSAs mostly span the southern part of Michigan, while a large part of Michigan is left uncovered.

To resolve this potential problem, in our second definition of education markets we consider both metropolitan statistical areas (MSA) and micropolitan statistical areas (mSA) as education markets, that is essentially we consider core based statistical areas (CBSA) as markets. The OMB defines a micropolitan statistical area as a core based statistical area that has at least one urban cluster of at least 10,000 but less than 50,000 population, plus adjacent territory that has a high degree of social and economic integration with the core as measured by commuting ties. CBSAs include metropolitan statistical areas and micropolitan statistical areas. In other words, under the "CBSA" definition of markets, a market is either an MSA or an mSA. The map in Figure 2 depicts CBSAs. Black lines, colors, and labels demarcate CBSAs (these are either MSAs or mSAs). The grey lines indicate school district boundaries.

Third, we also consider an alternative characterization of market where a market is defined as the area that falls within a certain radius from the centroid of a CBSA. We experiment with 10, 20, 30, 40, and 45 mile radii (or buffers).[5] To arrive at the upper bound of the radii we consider, we look at the biggest mainland MSA and measure of the radius of the circle that encompasses it. This is the Detroit-Warren-Livonia MSA and it takes a buffer of radius 45 miles to encompass it. Based on this measure, we use 45 miles as the upper bound of the radii we consider. The results are very consistent across the various radii, and we report results from 20 mile and 30 mile radii in this paper. Appendix Figure A1 depicts this characterization of markets where we present 20 mile buffers around the centroids of CBSAs. Black circles depict the 20 miles around CBSA centroid (the "markets"); black lines, colors, and labels depict the corresponding CBSAs.

Finally, we also consider another formulation of market, where a county is regarded as a market. A

[5] A note relating to allocation of districts to buffers that fell in more than one buffer is in order here. A district that fell in multiple buffers was assigned to the buffer that contained the highest share of its area. If a district was fully contained within 2 buffers, it was assigned to both.

caveat with this definition is in order here though. For a small urbanized area, a county may be large enough to encompass the districts in the education market. However, for a large urbanized area, the county may not be large enough to include all the relevant districts that may belong to the market. However, one advantage of the county definition is that markets under this definition encompass the whole of Michigan unlike the above definitions. Appendix Figure A2 represents counties and CBSAs. Counties are depicted in bold black lines while colors and labels demarcate CBSAs. We believe that a strength of our market analysis is that it includes various alternative definitions of markets – this enables us to test the sensitivity of our results to the different definitions of markets.[6]

The purpose of this paper is to investigate whether the Michigan school finance reform led to a reduction of residential sorting. More specifically, were there improvements in socio-economic and housing indicators in the low spending districts, and were they associated with corresponding declines in the high spending districts? For this purpose, we classify the Michigan K-12 school districts into different groups based on their pre-reform spending. 1993-94 was the last year before the reform, and state aid after the reform was based on spending in this year. So we classify the 524 K-12 school districts in Michigan into 5 groups based on the quintiles of the 1994 spending distribution.[7] Group 1 consists of the lowest-spending 105 districts, Group 2 consists of the next 105 districts in terms of spending, and so on, Group 5 consists of the highest-spending 105 districts. Appendix Figure A3 depicts the distribution of Michigan districts by these spending groups overlaid on CBSA boundaries. As can be seen there was considerable variation within CBSA boundaries implying that one can expect appreciable Tiebout-type mobilities within these markets.[8]

[6]MSA, mSA, and CBSA definitions and boundaries used in this paper are based on the 2000 census. We use the 2000 decennial census as the mSA definitions first appeared in the 2000 census. Of note is that the Michigan MSA boundaries in 2000 stayed the same as in the 1990 census.

[7]For the remainder of the paper, we will refer to school years by the calendar year of the spring semester, e.g. 1994 will refer to the 1993-94 school year.

[8]To ensure that our results are not driven by the presence of a few very large districts, we also estimate the specifications below after excluding the 5 largest districts in Michigan. These five districts are Detroit, Lansing and Grand Rapids (all in Group 4) and Flint and Utica (both in Group 5). The results remain qualitatively similar after such exclusions – they are not reported here to save space, but are available on request.

### 5.2 Changes in School Spending and Values of Housing Stock

To formally compare the effect of the program on school spending and values of housing stock in these different groups of districts, we estimate the following specifications using data from 1990 to 2001.

$$Y_{igmt} = \alpha_0 + f_m + \alpha_1 t + \sum_{g\neq 3} \alpha_{2g} D_g + \sum_{g\neq 3} \alpha_{3g}(D_g * t) + \alpha_4(reform) + \sum_{g\neq 3} \alpha_{5g}(D_g * reform) + \alpha_6(reform * t) + \sum_{g\neq 3} \alpha_{7g}(D_g * reform * t) + \varepsilon_{igmt} \quad (1)$$

where $g \in \{1, .., 5\}$, $Y_{igmt}$ is the per pupil spending or value of housing stock of district $s$ in Group $g$ in market $m$ in year $t$, $f_m$ represents market fixed effects, $t$ denotes time trend, and $D_g$'s are dummy variables for the respective groups of districts. Group 3, comprising of districts in the middle quintile of the pre-reform spending distribution, is the omitted category. The group dummies $D_g$ control for the base level differences between the various groups while $D_g * t$ controls for differences in pre-reform trends. $Reform$ is a binary variable that takes the value of 0 in the pre-reform period (1990-1994) and 1 afterwards (1995-2001). The variables $reform$ and $reform * t$ respectively control for post-program common intercept and trend shifts. The coefficients on the interaction terms $(D_g * reform)$ and $(D_g * reform * t)$ estimate the program effects – $\alpha_{5g}$'s capture the intercept shifts while $\alpha_{7g}$'s capture the trend shifts of different groups of districts.[9] All regressions in the paper use robust standard errors that are adjusted for clustering by school district.

Next, we estimate a completely flexible specification where we allow for full interactions between the group and year dummies. This specification allows the year effects for each of the groups to vary in an unrestricted way in both the pre- and post-reform period.

$$Y_{igmt} = \beta_0 + f_m + \sum_{g=1}^{5} \sum_{y=1990}^{2001} \beta_{gy}(D_g * D_y) + \varepsilon_{igmt} \quad (2)$$

where $D_y$ represents year dummies. We treat $(D_3 * D_{1990})$ as the excluded category, so the year effects obtained are relative to that of Group 3 in the initial year, 1990.

[9] For the nominal variables used below, the results are similar if we deflate them using the consumer price index for Midwest Urban (obtained from the U.S. Bureau of Labor Statistics). These are not reported but are available on request.

### 5.3 Effect on Socioeconomic Segregation

We investigate the effect of Proposal A on socioeconomic segregation using data from the three decennial censuses, 1980, 1990, and 2000. Using these census data, we estimate the following specification.

$$Y_{igmt} = \gamma_0 + f_m + \gamma_1 t + \sum_{g \neq 3} \gamma_{2g} D_g + \sum_{g \neq 3} \gamma_{3g}(D_g * t) + \gamma_4(reform * t) + \sum_{g \neq 3} \gamma_{5g}(D_g * reform * t) + \varepsilon_{igmt} \quad (3)$$

$Y_{igmt}$ is the value of the dependent variable (various socioeconomic indicators as detailed in section 6.3) in district $s$ in Group $g$ in market $m$ in census year $t$; $f_m$ represents market fixed effects; $t$ denotes time-trend, taking the values -1, 0, and 1 for 1980, 1990, and 2000 census years respectively. The variable $Reform$ is binary, taking the value of 1 for census year 2000 and 0 otherwise. In this specification, the coefficients $\gamma_{2g}$ control for the base level differences between the various groups, while $\gamma_{3g}$ measure the pre-reform trends of the various groups. The coefficients on the interaction terms ($D_g * reform * t$), $\gamma_{5g}$, capture the program effects. They represent the trend shifts of the different groups after controlling for differences in pre-program trends. As always, Group 3, the middle group of districts in the pre-reform spending distribution, is the omitted category in the regressions.

Next, we estimate a more flexible specification where we allow for full interactions between year and group dummies, thus permitting different year effects for each of the different groups both in the pre- and post-reform census years.

$$Y_{igmt} = \delta_0 + f_m + \sum_{g=1}^{5} \sum_{y} \delta_{gy}(D_g * D_y) + \varepsilon_{igmt} \quad (4)$$

where $D_y$ are year dummies and $y$ denotes census years 1980, 1990, 2000 respectively; $(D_3 * D_{1980})$ is taken as the excluded category implying that the effects are relative to that of Group 3 in 1980.

### 5.4 Effect on *Within-District* Segregation

As discussed in section 3.2, a school finance reform also has interesting implications for dispersion of incomes and other socioeconomic indicators *within* school districts. To investigate the effect of Proposal A on within-district segregation, we look at incomes of households and educational attainment. For each indicator, we use a measure of dispersion based on the Herfindahl index. We calculate the value of this measure for each district in 1990 and 2000, and compare the changes between these two years across the different groups of districts within markets.

The Herfindahl index, also sometimes known as the Herfindahl-Hirschman Index, originated in studies of market power in the industrial organization literature and is defined as the sum of the

squares of the market share of each individual firm. A nice intuitive measure of dispersion is given by one minus the Herfindahl index. Formally, assuming that households in each district are divided among $M$ mutually exclusive categories (in terms of incomes or educational attainment), this measure of dispersion is defined as $1-\sum_{i=1}^{M} s_i^2$, where $s_i$ is the share of the $i^{th}$ category. The intuitive interpretation is that if one randomly picks up two households in a district, this measure gives the probability that they do not belong to the same category. The measure lies between 0 and 1 – a value of zero implies that all households in the district belong to the same category, while a value close to 1 implies that the population is roughly equally divided among all the categories. Thus a move from 0 towards 1 – or an increase – implies an increase in within-district dispersion. This particular measure of dispersion has been widely used in previous studies in the literature, see for example, Hoxby (2000).

In each district, we divide households and persons into different categories based on census data. For incomes, households in each district in each census year are divided into 15 categories. For educational attainment, persons in each district over the age of 25 are grouped into the following four categories – less than high school education, high school graduate, some college, and bachelor's degree or more.[10]

# 6 Results

## 6.1 Income and Spending in the Pre-reform period

During our period of analysis, there were 524 K-12 school districts in Michigan. In the pre-reform period each of them were fiscally independent. This, coupled with the predominance of local control in school affairs, led to socioeconomic segregation along district lines. Table 2 provides some illustrative evidence on the extent of disparities in household incomes and per pupil spending across school districts, *even within the same county*, in pre-reform Michigan. While this study includes all 524 K-12 school districts (and the corresponding 83 counties), Table 2 focuses only on a subsample of counties. Each Michigan county that had more than 10 K-12 school districts are included in Table 2. There were 14 such counties. For each of these counties, Table 2 shows the median household income in the richest school district as a percentage of that in the poorest school district. As can be seen from column (2), in 1990 there were very significant differences in incomes between the richest and the poorest school districts even within the same county. In each of these counties except Jackson county, the median income in the richest school district was almost twice as high as that in the poorest district, often even higher. The differentials

[10]The value of this measure of dispersion, based on the Herfindahl index, is sensitive to the number of categories. However, since we are only interested in a comparison across groups of school districts and moreover, want to compare the changes in this measure over time, this should not be a problem. The results remain qualitatively similar if we use alternative definitions of categories.

were generally higher for counties which had more school districts – a larger number of school districts allowed for a greater degree of stratification. Column (4) shows that these large differences in median incomes translated into large differences in school spending in 1990 – the highest income school districts tended to spend considerably more, while the lowest income districts spent considerably less. The pre-reform situation was thus associated with income and spending disparities within markets, and closely corresponded to a Tiebout-type sorting of households into desired (educational) jurisdictions within markets. While this table shows disparities between districts within counties, a similar pattern emerges (not reported here for lack of space), if we use other alternative market definitions employed in this paper such as MSAs, CBSAs, or various reasonable radii around centroids of CBSAs.

In an alternative exposition, Figure 3 presents the relationship between per pupil spending and median household income across Michigan school districts in the immediate pre-program period.[11] As can be seen there was a significant positive relationship between the two variables, with high-income districts also spending considerably more on their students. However, of note is that despite this general positive relationship, there were some exceptions for specific school districts. For example, Detroit and Flint school districts (highlighted with bigger markers and different colors) had high per pupil spending, even though they had relatively low median household income. The dynamics in these school districts were different. These big urban districts enrolled and educated a disproportionately high share of low income households, and students from low income households are generally more costly to educate. As a result, per pupil spending may not be a good proxy for the level of educational inputs in these districts. Thus, it is important to point out that some of the big cities were different, but it also remains the case that on average Michigan school districts exhibited a clear positive relationship between median household income and spending in the pre-reform period.[12] Similar positive relationship between spending and income during the pre-program period for the Michigan school districts has also been documented in the literature (Cullen and Loeb (2004), Roy (2011)).

It is also worth noting here that high per pupil spending in Michigan, in general, was not associated with high needs. A comparison of the characteristics of Group 5 and Group 1 districts from this perspective may be useful. Group 5 districts had significantly higher value of per pupil housing stock

[11] In this paper, per pupil revenue has been interchangeably referred to as per pupil revenue and per pupil spending. Note that, as seen in Roy (2011) per pupil revenue matched per pupil spending (or expenditure) very closely, and their patterns were very similar both before and after the reform. This figure uses per pupil revenue data for the last pre-program year (1994); median household income pertains to 1990 as data for this variable come from the decennial census.

[12] As noted earlier, we estimate alternate versions of the regressions – not reported here for lack of space but available on request – where we exclude the biggest five districts. The results are similar. Looking at Appendix Figure A3, it is evident that in the pre-reform period there were significant variations in per pupil spending in districts within the CBSAs, even if we drop the five big districts. This likely contributes to the similarity of the results.

than Group 1 districts ($205,228 versus $79,420), lower percentages of students eligible for free-lunches (19% versus 26%), markedly higher median household income ($33,761 versus $24,239), higher median gross rent ($454 versus $337), higher percentage of housing units occupied (83% versus 75%), lower civilian unemployment rate (8.2% versus 9.6%) and lower percentage of households with public assistance income (7% versus 10%). They also had a more educated population (22% versus 27% less than 12th grade, 46% versus 33% at least some college, 19% versus 9% Bachelors or more), and higher standardized reading (0.23 versus -0.8) and math (0.28 versus -0.21) scores. Thus, while Group 5 districts had higher revenue per pupil ($6,809 versus $4,258), this higher revenue did not come from high needs, rather these districts were more advantaged in terms of various socio-economic indicators.

An alternative way to look at this issue is to use pre-program *district-specific* cost of living indices to see if real spending exhibited similar hierarchy across the various groups as nominal spending. We use Standard and Poor's cost-of-living indices for Michigan school districts. These adjust for geographic differences in the purchasing power of the dollar that existed between school districts in the state, that were due to variations in the cost of living and labor markets. Thus adjusted, real per pupil spending for the different groups of districts in the immediate pre-program period (1994) are presented in Table 3 along with the corresponding nominal per pupil spending numbers in 1994. Indeed, the table shows that real per pupil spending was similar to nominal per pupil spending, and more importantly, maintained the same hierarchy across groups as nominal per pupil spending.

Since Group 1 districts are the focal group of districts studied in the paper, Table 4 presents the pre-reform characteristics of Group 1. To place these in perspective, we also report the corresponding county averages. Not surprisingly, Group 1 districts had relatively low per pupil revenues, with the average district within the same county spending 7% more, a difference which is statistically significant. The differences are even larger for the value of housing stock, reflecting perhaps the relatively low attractiveness of districts in Group 1 compared to its same-county peers. Geographically, Group 1 districts are generally located in areas with similar population density. The schools in these districts had somewhat higher shares of free lunch eligible students, lower (standardized) reading and math test scores, lower median gross rent and household income, higher unemployment rate and percentage of households with public assistance income, and lower levels of educational attainment, although not all these differences were statistically different from zero. Thus, this table reveals that the low spending districts were indeed relatively poor, low performing, and had relatively lower socioeconomic characteristics in comparison to their peers in the same county. To summarize, the analysis in this section suggests that the low spending districts contained relatively disadvantaged households with

lower SES, while the higher spending districts contained relatively advantaged high SES households.

### 6.2 Changes in School Spending, Values of Housing Stock, and Enrollment Share

Against this backdrop of socio-economic disparities in the pre-reform period, we next investigate the impact of the school finance reform on residential sorting. Before moving on to the formal analysis, Table 2 presents the changes in median household incomes and per pupil expenditures in districts within the 14 large counties in post-reform Michigan. Recall that this table uses 14 counties (out of 83) that have at least 10 K-12 school districts, while all other analysis in this paper uses all 524 K-12 school districts. We find that there has been a significant decrease in disparities in school spending in the post-reform period. The ratio of spending between the richest and the poorest districts in each county has gone down considerably. For example, while in 1990 the *smallest* ratio between the richest and the poorest school districts in a county was about 29% (Lenawee county), in 2000 in half the counties the ratio was 25% or less. The effect on dispersion of household incomes is comparatively modest, though the gap has declined in most counties.

Figure 4 shows the distributions of per pupil revenues in the lowest spending and the highest spending groups of districts (Groups 1 and 5). We compare the distributions for 1994 (the last year before the reform) to those in 2001 (seven years after the reform). There has been a significant convergence between these groups after the reform, particularly due to the fact that the lowest spending districts witnessed large increases in revenues after Proposal A which shifted their distribution to the right. Figure 5 similarly compares the distributions of per pupil housing stock in groups 1 and 5 districts in 1994 and 2001. While there is evidence of convergence with increase in values of housing stock in the lowest spending districts in the post-reform period, this seems to have been relatively modest compared to the revenue equalization in Figure 4.

The results from estimating specification (1) using per pupil revenues as the dependent variable are presented in Table 5 and Online Appendix Table B1. Table 5 presents results for two educational markets – CBSAs (columns (1)-(2)) and 30 mile radii around CBSA centroids (columns (3)-(4)). Results for the other alternative market definitions are presented in Online Appendix Table B1. For benchmarking, columns (1)-(2) in Online Appendix Table B1 present results from estimation that include district fixed effects. Columns (3)-(4) consider MSAs as markets, (5)-(6) consider counties as markets, (7)-(8) consider 20 mile radii around CBSA centroids as markets. For lack of space, these tables present post-program effects only. Appendix Table A1 presents both pre-program trends and post-program effects for two market definitions: CBSA and 20 mile radii. For revenues, the gap between the highest

spending and the lowest spending districts has been increasing in the years before the reform (Table A1 columns (1)-(4)), and the difference in pre-trends was also statistically significant. Of note is that there was a clear hierarchy – the pre-reform trends in per pupil revenues were higher in the school districts which were already spending more. Post-reform, however, this was reversed. The reform led to a significant increase in trend in revenues in the Group 1 school districts. In contrast, the Group 5 districts endured economically and statistically significant intercept and trend declines, which were also statistically different from the corresponding Group 1 shifts. Thus, the Group 1 districts demonstrated a significant catch-up relative to the high spending districts. The results are remarkably robust across markets, and remain qualitatively similar irrespective of the market considered.

Some perspective on the size of the effects may be useful here. As a percentage of the corresponding group's baseline pre-program spending per pupil (after controlling for pre-reform trends), per pupil spending in Group 1 districts increased by 3.5% per year in the post-reform period, while it decreased by 1.2% per year for Group 5 districts along with an immediate decline (intercept shift) of 2.1% in this group of districts, under the market definition of CBSA. For the 20 mile (30 mile) market definitions, the numbers were a per year increase of 3.7% (3.7%) for the low spending districts, while the high spending districts faced an immediate decline of 2.4% (2.1%) coupled with a yearly decline of 1.1% (1.2%) during the post-program period. For the CBSA market definition, this is equivalent to a 25% increase in per pupil revenue in the low spending districts after seven years, and an 11% decrease in the high spending districts in the same time period.

We next estimate specification (2) using per pupil revenue as the dependent variable. The coefficients yield unrestricted year effects for the various groups during the pre- and post-reform periods. Figure 6 Panel A plots these coefficients for groups 1 and 5 respectively where CBSAs are taken as markets, while Figure 7 Panel A plots these where 30 mile radii around CBSA centroids are taken as markets. Corresponding standard error bars and levels of significance of the coefficients are also shown. Consistent with the above results, the figures show a widening of the gap between the two groups in the pre-program period in each of the markets, and a convergence in per pupil spending after the reform.

Table 6 studies the impact of the reform on the value of housing stock, which is known as state equalized valuation in Michigan. Columns (1)-(2) consider CBSAs as markets, while columns (3)-(4) consider 30 mile radii around CBSA centroids as markets.[13] As for per pupil revenue, for lack of space we present pre-reform trends for only two markets (CBSAs and 20 mile radii) in Appendix Table A1 columns (5)-(8). Prior to the reform, there were statistically and economically significant gaps in trends

[13] Online Appendix Table B2 consider two other alternatives. Columns (1)-(2) include district fixed effects while columns (3)-(4) consider 20 mile radii around CBSA centroids as markets.

in the value of housing stock between the highest and the lowest spending districts. In fact, just like for school revenues there was a clear monotonicity in pre-reform trends – Group 1 districts were lagging behind Group 2 districts, which in turn were lagging behind Group 3 districts, and so on. Post-reform, however, there was a reversal with the post-reform trend coefficients maintaining a strict, but opposite, hierarchy. Group 5 districts sustained negative intercept and trend shifts, which are both economically and statistically significant. Group 1 districts experienced positive intercept and trend shifts and each of these shifts is statistically different from those of the corresponding Group 5 shifts. These results are robust to alternative market definitions.

It follows that the results for the value of housing stock mirror those for revenues qualitatively. There is an important difference between the two sets of results though. For school revenues, the lowest-spending districts witnessed higher trends, in an absolute sense also (as seen from the sum $\alpha_{31} + \alpha_{71}$) in the post-reform period, relative to the high spending districts. For housing wealth, however, districts in the highest spending communities (Groups 4 and 5) continued to have higher trends (in an absolute sense) than districts in Groups 1 and 2 in the post-reform period, though the *gap in trends* has narrowed. In other words, though there was a positive relative post-reform shift in trends for housing wealth in the lowest spending districts, this was not sufficient to outweigh the large gap in pre-reform trends between them and the highest spending districts, unlike for school spending. One potential reason for this may be the strength of peer effects at the local level, where the presence of more educated and wealthy households in a community increases the demand for residence in that community. However, it is important to note here that this explanation should only be taken as suggestive, and not necessarily causal. The objective of this paper is to investigate the impact of the school finance reform on indicators in various groups of districts, separating out the impact of change in peer effects from other factors such as change in spending is outside the purview of this paper. Another reason for the modest effects may be the staggered nature of the program in Michigan, coupled with the 'hold-harmless' clause in the law, which implies that some high-spending districts may still remain attractive in the immediate post-reform period, moderating the movement towards lowest-spending districts.

To put the results into perspective, it might be worthwhile to compare the effects obtained here with those in Dee (2000). Dee (2000) argues that in the poorest school districts in the states where school finance reforms were mandated by court rulings, housing values and rents went up by at least 8 percent, implying that a large share of the new per pupil spending was capitalized into residential rents. When CBSAs are considered as markets, the results in this paper reveal that the reform led to an immediate increase in the value of housing stock by 2.6% along with an increase of 0.5% per year in the Group 1

districts. These numbers were 2% (2.5%) and 0.3% (0.6%) for the 20-mile (30-mile) market definitions. Under the CBSA definition, this amounts to an increase in housing wealth by approximately 6% after 7 years in the Group 1 districts. In contrast, for the high spending districts, there was an immediate decline of 3.8% (3.8%) along with a per year decrease of 0.7% (0.7%) under the market definition of CBSA (30 mile radii). This is equivalent to an approximately 8.7% decline in the value of housing stock seven years after the program in the Group 5 districts.

To sum, following the school finance reform the lowest spending districts were able to narrow the gap in growth rates of housing wealth between them and the highest spending districts. However, the absolute gap between these groups still remained large. It is evident that the effect of Proposal A on the value of housing stock was more modest compared to the equalization of school resources.

Table 7 studies the impact of Proposal A on enrollment shares in the various groups of districts. It considers two definitions of markets: (i) CBSAs and (ii) 30 mile radii. After controlling for pre-program trends, there is evidence of an increase in enrollment shares in the form of both positive intercept and trend shifts in Group 1 districts. There is also some evidence of decline in enrollment share in Group 5 districts. However, these coefficients are not always statistically significant. The results are once again robust to the various definitions of market considered.

### 6.3 Effect on Socioeconomic Segregation

We use data from the last three decennial censuses to analyze changes in socioeconomic segregation in the post-reform period. Controlling for pre-existing trends and market fixed effects, we analyze the effect of Proposal A on different groups of districts within markets. More specifically, the results capture whether there was a reduction of socio-economic segregation within these markets after the reform. We report results for three market definitions – CBSA, 20 mile and 30 mile radii around centroids of CBSAs respectively. Results for CBSA and 30 mile radii are reported in Tables 8 and 9, while results for 20 mile radii are reported in Online Appendix Table B3. Results for the other market definitions are not reported for space constraints – they are similar and available on request. Results in this section are obtained from estimations of specification (3) for the various market definitions.

The theoretical discussion in section 3.1 suggests that following a school finance reform, when resources are equalized across different groups of districts, the low spending districts would be expected to witness inflows of population from their higher-spending counterparts within the education market. However, depending on factors like the elasticity of supply of housing, the extent of this inflow might be diluted by increases in property values in the former and decreases in the latter. Second, if peer

effects are strong and positive, and richer and more educated neighborhoods are perceived to provide more desirable peer groups, the outflows from the richer and higher spending districts may be smaller in magnitude.

We begin our analysis by looking at changes in housing variables. Table 8 Panel A and Online Appendix Table B3 Panel A examine the impacts on three key housing-related variables – percentage of housing units in a district that are occupied, percentage of owner-occupied housing units, and median gross rent.[14] The percentage of housing units occupied went up by the largest amounts in Group 1 districts after the reform. The same is true for the percentage of occupied units that are owned. Residential rents also show a similar pattern – the coefficients on Group 1 districts are positive and modestly large, although they are not statistically significant. For most of these variables, the coefficients on the highest spending group (Group 5) are negative, and are statistically different from the corresponding Group 1 coefficients.

Table 8 Panel B and Online Appendix Table B3 Panel B look at variables related to the average socioeconomic status (SES) in a school district. It analyzes impacts on three income and employment-related variables – median household income, percentage of households with public assistance (PA) income, and the civilian unemployment rate. Each of these indicators improved in the Group 1 districts and declined in the Group 5 districts in the post-reform period, and the Group 5 effects were almost always statistically different from the corresponding Group 1 effects.

Table 9 and Online Appendix Table B3 Panel C presents results on variables relating to educational attainment. We include the following three measures – the percentage of adults with less than 12th grade schooling, the percentage with at least some college education (including a bachelor's degree), and the percentage with at least a bachelor's degree. Relative to pre-reform trends, the lowest spending districts in Group 1 showed the largest improvements in the post-reform period for the first two measures, though the coefficients for the first measure are not statistically significant. In contrast, the Group 5 districts witnessed statistically significant declines in the percentage of adults with at least some college, and this effect is also statistically different from the corresponding Group 1 coefficients. However, as far as the percentage of college graduates is concerned, it is the districts in Group 5 that have the largest coefficients, though these are not statistically significant. This suggests that these richest and highest-spending districts continued to enjoy superior peer groups – at least in terms of educational attainment.

Some discussion relating to the size of the above effects may be helpful here. Considering the CBSA market definition, and as a percentage of baseline values for the corresponding group and variable,

[14]This table (as well as Tables 9 and 12) only reports results from regressions that are weighted by the population of school district. Of note is that the unweighted results are similar to the weighted ones and are available on request.

the reform led to a 7% increase in occupancy, 2% increase in percentage of houses that are owner occupied, 3% increase in gross rent, 8% increase in median household income, 8% decline in percentage of households with public assistance income, 15% decrease in civilian unemployment, 2% decrease in percentage of adults with less than 12th grade education, and a 7% increase in percentage with at least some college in the Group 1 districts six years after the reform, though not all these effects are statistically significant. For Group 5 districts, the reform led to an increase of 1% in occupancy (though this is not statistically significant), and decreases of 11% in median gross rent, 8% in median household income, 4% in percentage of adults with at least some college degree six years after the reform under the market definition of CBSA.

Figures 6 and 7 present coefficient plots (and corresponding standard error bars and statistical significance levels) from estimation of specification (4) for various census variables. Figure 6 presents the results where CBSAs are taken as markets while Figure 7 considers 30-mile radii around CBSA centroids as markets. The patterns mirror the results obtained above – there are perceptible reductions in gaps between the Group 5 and Group 1 districts indicating catch-up by Group 1 districts.[15] As Figures 6 and 7 reveal, the patterns are similar across the two market definitions (CBSA and 30-mile radii) for each of the variables under consideration, reinforcing the robustness of the results.

While these figures present visual evidence of convergence, some discussion on the economic significance of convergence may be worth here. For perspective, the pre-reform gaps were respectively $2389 for per pupil revenue, 3.06 percentage points for civilian unemployment rate, $7242 for median household income, 3.34 percentage points for households with public assistance income, 4.89 percentage points for percentage of housing units occupied for the CBSA market definition (Figure 6). Comparing the gaps between pre-reform and post-reform[16], the coefficient plots reveal that the reform led to 26% reduction of the revenue gap, 38% reduction of the gap in civilian unemployment, 53% reduction of the gap in percentage of households with public assistance income, 4% reduction of housing occupancy gap, while the gap in median household income essentially remained the same. Thus the reductions in gaps (or convergences) are economically significant in most cases. It is worth emphasizing here that the gaps in the pre-reform period were increasing for median household income and most other indicators (Figures 6 and 7). So, in the absence of the reform (if the pre-reform trends were maintained) the gaps in 2000 would have been wider than those in 1990. For example, assuming continuation of the same

[15]For space constraints, we present coefficient plots in Figures 6 and 7 for only a subset of our variables. Coefficient plots for the other variables mimic above results in tables 5-9 and are available on request.

[16]In this paragraph, pre-reform (post-reform) relates to 1994 (2001) for per pupil revenue and 1990 (2000) for the census variables.

trend as existed between 1980 and 1990, the projected gap in median household income in 2000 would have been $11909 for the CBSA market definition. While the actual 2000 gap for median household income is essentially the same as that in 1990, it is 62% of the projected gap implying a 38% reduction in gap due to the reform.

### 6.4 Are the Effects of the Reform Reflected in a Change in School Quality (Scores)?

It is instructive to investigate whether the reform affected school scores, and whether these changes (if any) were congruent with the changes in revenue and socio-economics seen above. This relationship is important, as improved test scores may very well have served as a mechanism that fueled the changes above. For example, if an increase in spending in the low spending districts was indeed reflected in higher test scores, then this in turn might have increased the demand for these districts leading to increases in housing values and improvements of socio-economics (due to migration) in these districts, as seen above.

We use MEAP reading and math scores that are each standardized to have mean zero and standard deviation one. Figure 8 graphs the relationship between change in per pupil revenue due to the school finance reform and change in test performance. The changes for each variable relate to the change from 1994 (the last year before the reform) to 2001 (the last year in our sample). The left panel in Figure 11 pertains to reading while the right panel pertains to math. As can be seen, there was a strong positive relationship between change in per pupil revenue and change in test scores (both reading and math). In other words, an increase in spending following the school finance reform was associated with increases in both reading and math scores on average.

Figure 9 presents the relationship between change in housing wealth and change in scores during the same period. The left panel relates to reading, while the right panel relates to math. Once again, each of the panels show a clear positive relationship, implying that districts that saw an increase in the value of housing stock also saw an increase in test scores on average (in both reading and math), and vice versa. This analysis suggests that the reform did indeed lead to changes in test performance that were congruent with the patterns in housing and socioeconomic segregation seen above.

These findings conform well with those in the literature (Papke (2005), Papke (2008), Roy (2011)) – these studies find robust evidence that the reform led to substantive gains in test scores in the lowest spending districts and the gap in educational outcomes between the highest and lowest spending districts narrowed. The findings in Roy (2011) are especially relevant to this study as it employs the same classification of districts into Groups 1-5 on the basis of pre-program spending quintiles as

employed in this paper. Controlling for differences in pre-program trends between various groups of districts and post-program common shifts, it finds statistically significant evidence of improvements in test scores (both MEAP reading and MEAP math) in Group 1 districts due to the reform. In addition, it finds evidence of statistically significant declines in reading and math scores in Group 5 districts following the reform. (See Table 6 in Roy (2011) for more details.)

### 6.5 Changes in segregation *within* districts

Table 10 compares the average values of the measure of dispersion (based on the Herfindahl index, see section 5.4) in the different groups of districts between 1990 and 2000.[17] For educational attainment, all the groups except those in the upper middle quintile (Group 4) had similar values in 1990. Over the next decade, while the lowest spending districts witnessed an increase in dispersion, the measure declined in the highest spending districts. For household incomes, although there was an increase in income dispersion in all districts in 2000, the increase was by far the largest in Group 1 districts. In fact, by the year 2000, the lowest spending districts were the most heterogeneous with respect to household incomes.

Table 11 explores the effects of the reform on this measure of dispersion in two education markets – CBSA and 30 mile radii. Panel A presents results for household income while Panel B presents results for educational attainment. Online Appendix Table B4 presents two other alternatives – results that include district fixed effects (columns (1)-(2) in each of the panels) and results that consider 20 mile radii around CBSA centroids as markets (columns (3)-(4) in each panel). Results for the other markets are not reported for space constraints – they are also similar and available on request. The results confirm the general pattern seen in Table 10. For each market definition, and for both educational attainment and household incomes, within-district dispersion increased the most in the lowest spending districts (Group 1). Conversely, the highest spending districts saw a sharp decrease in dispersion, as intuitively predicted by the theoretical discussion in section 3.2. Also of note here is that the change in within district dispersion in the Group 5 districts was statistically different from that in the Group 1 districts in almost all cases. These results differ from Aaronson (1999) in a key way. While he finds that school finance reforms increased the dispersion in low spending districts he does not find any effect in high spending districts. In contrast, we find that within district heterogeneity increased in low spending districts and decreased in high spending districts.

[17] Income was differently categorized in the 1980 census, as compared to the 1990 and 2000 censuses (in terms of the ranges of the respective bins). Since use of the Herfindahl index-based measure of dispersion requires consistent categories (across years) for comparison, this precluded use of income data from the 1980 census in these calculations. The results for educational attainment are similar if we include data from the 1980 census.

# 7 Robustness Checks

## 7.1 Investigating the Role of Secular Trends: Are Similar Patterns Observed in Neighboring Ohio?

It is important to investigate whether the results above were driven by national or regional secular trends or shocks during the period under consideration. For example, one might argue that the results above were contributed by urban sprawl during that period rather than the Michigan school finance reform. To investigate the role of such secular trends, we examine whether similar patterns were observed in neighboring Ohio. Note that Ohio did not face school finance equalization during this period, unlike Michigan.

For this falsification analysis, we obtain school spending data from the Ohio Department of Education, and decennial census data for the 1980, 1990, and 2000 censuses for the Ohio school districts. Next, mimicking the school district classification strategy in Michigan, we classify the Ohio school districts into five groups based on quintiles of Ohio school district spending per pupil in 1993-94. School districts falling in the bottom quintile of Ohio's 1993-94 spending distribution are labeled as Group 1 districts, those falling in the second quintile as Group 2 districts, and so on.

As a first step, we use census data for Ohio and estimate the same specification as used for the corresponding Michigan analysis (specification (3)), and use the same market definitions. The results of this analysis from three market definitions (CBSA, 20-mile and 30 mile radii) and a subset of indicators used above are reported in Online Appendix Table B5.[18] Panel A presents results for percentage of housing units occupied, median gross rent, and median household income; Panel B presents results for percentage of households with public assistance income, civilian unemployment rate, and percentage of adults with less than 12th grade schooling. There is no evidence of any differential trends in any of the groups except for percentage of households with public assistance income. The percentage of households with public assistance income seems to have decreased in the Group 5 districts. Also note that this pattern is very different from that observed in Michigan where there were *increases* in the percentage of households with public assistance income in Group 5 districts and declines in Group 1 districts. This analysis suggests that the results for Michigan above are unlikely to be caused by urban sprawl or other secular or regional trends.

To explore further, we estimate the following specification where we estimate the impacts in Michigan

[18] For lack of space, we only report results for a subset of indicators and a subset of markets. The results for the other indicators and other market definitions are similar, and are available on request.

relative to those in Ohio using census data for the two states.

$$Y_{igmst} = \phi_0 + f_m + \phi_1 t + \sum_{g\neq 3} \phi_{2g} D_g + \sum_{g\neq 3} \phi_{3g}(D_g * t) + \phi_4(reform * t) + \sum_{g\neq 3} \phi_{5g}(D_g * reform * t)$$
$$+\phi_{0,MI} MI + \phi_{1,MI}(t * MI) + \sum_{g\neq 3} \phi_{2g,MI}(D_g * MI) + \sum_{g\neq 3} \phi_{3g*MI}(D_g * t * MI) + \phi_{4,MI}(reform * t * MI)$$
$$+ \sum_{g\neq 3} \phi_{5g,MI}(D_g * reform * t * MI) + \varepsilon_{igmst} \quad (5)$$

where $Y_{igmst}$ is the value of the dependent variable (various socioeconomic indicators as detailed in section 6.3) in district $i$ in Group $g$ in market $m$ in state $s$ in census year $t$, where $s = \{MI, OH\}$; $MI$ is a dummy for Michigan.[19] The coefficients of interest are $\phi_{5g,MI}$ which capture the program effects. They represent the post-reform trend shifts of the different Michigan groups over and above any post reform trend shifts of the Ohio groups after controlling for pre-reform trends of the various groups.

The results for this analysis are presented in Table 12 and Online Appendix Table B6. Table 12 reports results for two markets – CBSAs and 30 mile radii around CBSA centroids, while Online Appendix Table B6 reports results for 20 mile radii around CBSA centroids. After controlling for pre-reform trends and any common secular trends (as captured by patterns in Ohio), the patterns in Michigan for the various groups mimic the patterns obtained above in section 6.3.[20] The impact estimates for the various groups in Michigan are economically and statistically quite similar to those obtained in section 6.3, except (as can be expected from Online Appendix Table B5) they are somewhat muted for median gross rent and median household income. In terms of the sizes of the effects, Table 12 finds that the reform led to 7% increase in occupancy, 0.4% increase in gross rent, 4% increase in median household income, and 3% decrease in percentage with less than 12th grade schooling in the Group 1 districts six years after the reform for the CBSA market definition, though not all these effects are statistically significant. For Group 5 districts, the reform led to an increase of 1% in occupancy (though this is not statistically significant), and decreases of 9% in median gross rent and 5% in median household income six years after the reform (under the CBSA market definition). Once again, for each of the indicators and for each of the market definitions, the improvements are the largest for Group 1 districts and almost always the least (or declines are largest) for the Group 5 districts. As in section 6.3, the Group 5 shifts also continue to be statistically different from the corresponding Group 1 effects in most cases. To summarize, while the impacts for median gross rent and median household income

[19] Note that $MI$ is applicable only to specifications that consider radii around CBSA centroids as markets because the buffers often overlap; it will be absorbed by the market fixed effects for the other market definitions.

[20] Results for the other markets and other variables are also qualitatively similar to those presented in section 6.3. They are not reported for space constraints, but are available on request.

are somewhat muted, the results continue to be qualitatively similar to those obtained in section 6.3 (and economically similar too in the other cases), and confirm the finding of post-reform declines in socioeconomic stratification obtained there. This analysis implies that the patterns obtained above are unique to Michigan, and gives confidence that they are not driven by secular regional or national factors.

### 7.2 Examining the Role of Charter Schools as a Potential Confounding Factor

One important institutional change that took place in Michigan during the 1990s was the introduction of charter schools.[21] However, even though charter schools spread rapidly in Michigan, they still served only a small percentage of overall K-12 students (Arsen et al. (2001)). Second, the presence of charter schools would bias our results for the lowest spending districts only if it were true that these schools were relatively more concentrated in these districts – so that property values went up due to charter schools, and wealthier and more educated households relocated to these districts to take advantage of these schools. However, the opposite is true in Michigan (see Roy 2011). Charter schools in Michigan are mostly located in the high spending districts. Geographically, many of the charter schools are located in southeast Michigan, particularly in Wayne county, where they serve mostly students living in the suburbs or inner city Detroit.[22] To test the robustness of our results to the charter school spread, we separately exclude (1) Wayne county and (2) Detroit school district from our analysis, and re-estimate the above regressions. The results remain very similar and are available on request.

So charter schools are unlikely to have been the catalyst behind the results seen above. One might argue though, that one explanation for the continued high demand for residences in the highest spending districts was the opportunity to take advantage of the growth of charter schools in these school districts. However, this does not seem to be a plausible reason because prior literature has failed to document significant positive effects of Michigan charter schools on student achievement (Eberts and Hollenbeck (2001), Bettinger (2006), Chakrabarti and Roy (2010)). As a result, it is unlikely that the presence of charter schools in the high spending districts was the driving factor behind the continued high demand for residences in the highest spending districts.

[21] There was also an inter-district choice program in Michigan. However, it was very small – only about 1% and 1.5% of Michigan public school students enrolled in public schools outside their home district in 2000 and 2001 respectively, see Arsen et al. (2001). As is somewhat true for charter schools too (see below), public school choice is mainly concentrated in and around Detroit, see Cullen and Loeb (2004, page 242).

[22] None of the school districts in Wayne county fall in the lowest spending quintiles (Groups 1 and 2). In fact, most of the school districts in Wayne county fall in Group 5, the highest spending quintile, as these are located in the affluent suburbs of Detroit.

### 7.3 Assessing the Role of Private School Markets

First, if there were changes in the private school markets – either as a result of Proposal A or independent of it – then this might have direct effects on segregation within and across districts. For instance, if the reform led to a perception of improvements in public school quality in the low spending districts, then this might have led to migration of private school households to low spending districts. To investigate if this has been the case, we used decennial census data to look at the changes in private school enrollment across Michigan school districts within markets between 1990 and 2000. The results for two market definitions (CBSA, 30 mile radii) are in Table 13 – the results for the other market definitions are similar and are available on request. There is no evidence of any differential changes in private school enrollment across different groups of districts during this period.

### 7.4 Examining the Role of Michigan's Manufacturing Sector

A concern is the secular decline in auto and manufacturing industries in Michigan throughout the last two decades. It is possible that these structural shifts in the economy in turn led to demographic shifts, biasing our results. 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 whether mobility patterns triggered by the decline in Michigan's manufacturing industries might have contributed to the above patterns. We use two strategies for this purpose. First, using decennial census data, we look at the trends in the percentage of workforce employed in manufacturing, and examine if there were different post-program trends in manufacturing employment across the different groups of districts. Second, we explicitly control for percent manufacturing in the above regressions to examine whether our results are sensitive to this inclusion.

The results in Table 14, which examine changes in the percent of workers employed in manufacturing, show that there actually 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-program period across the various groups of districts.

Next we directly control for the percentage of the labor-force employed in manufacturing in each school district in our census regressions. The results remain very similar to those obtained above – the inclusion of the share of workforce in manufacturing does not affect the patterns seen above. These

results are not reported here for lack of space, but are available on request. To sum, prevailing economic conditions particularly as they relate to employment in manufacturing do not seem to have differentially affected Michigan school districts during the 1990s. Moreover, when controlled for separately in the census regressions, they do not alter the picture seen above.

# 8 Conclusions

Neighborhood-based school finance systems, particularly in the U.S., have been argued to generate and perpetuate residential segregation (Nechyba, 2003). A school finance reform, which substitutes state aid for locally-raised revenues and raises spending in the lowest-spending school districts, has the potential to alter the extent of this segregation. In this paper, we study the Michigan school finance reform of 1994, called Proposal A, to analyze the impact a change in school financing can have on socioeconomic segregation. Proposal A ended local discretion over school spending and resulted in a large increase in state aid to the lowest spending districts in Michigan. Prior to Proposal A, Michigan districts could decide their own educational expenditures, and this had resulted in widespread disparities in per pupil spending across school districts in the state. These spending disparities were accompanied by large disparities in median household incomes, educational attainment, and other socioeconomic variables.

Employing a difference-in-differences estimation strategy in trends with market fixed effects, and using data from the Michigan Department of Education, Ohio Department of Education, the National Center for Education Statistics, and the 1980, 1990 and 2000 decennial censuses, we investigate whether the reform had any significant effects on per pupil spending, value of housing stock, and socioeconomic composition of school districts. This is the first paper to undertake a comprehensive analysis of a major school finance reform on socioeconomic stratification. An important contribution of the paper is that we define education markets, constituting areas that facilitate Tiebout-type migration within their confines, and explore changes in housing and segregation within these markets. Also, unlike previous studies in the literature, we consider a wide range of indicators including housing, income, and educational attainment, and look at both across-district and within-district dispersion.

We find that Proposal A was responsible for significant increases in per pupil spending in the lowest spending school districts. It led to increases in the values of housing stock and improvements in several socioeconomic indicators in the lowest spending districts. In contrast, the highest spending districts endured declines in most of these indicators. These resulted in a perceptible decline in neighborhood stratification in the post-reform period. Of note though is that while the reform led to convergence, there was still a significant gap between the highest spending and the lowest spending school districts

in most such indicators. For example, there was continued high demand for housing in the highest spending districts. One suggestive explanation for the latter may be the strength of the local peer effects or neighborhood 'social capital' (Benabou (1996)). We also find that within-district heterogeneity in household incomes and educational attainment went up in the lowest spending school districts, and fell in the highest spending districts. The results of this paper have important policy implications. They suggest that a large program of government aid targeted to poorer communities can reduce the existing level of neighborhood socioeconomic stratification, but communities with the richest and the most educated households can still continue to remain attractive.

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Table 1: Increase in Foundation Allowances, Post-reform Michigan
(Selected districts at different percentiles of pre-reform spending distribution)

| School District | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 |
|---|---|---|---|---|---|---|---|---|
| Standish Sterling Community Schools (1st percentile) | 3,738 | 4,200 | 4,506 | 4,816 | 5,124 | 5,170 | 5,700 | 6,000 |
| Harrison Community Schools (5th percentile) | 3,905 | 4,200 | 4,506 | 4,816 | 5,124 | 5,170 | 5,700 | 6,000 |
| Adams Township School District (25th percentile) | 4,321 | 4,566 | 4,832 | 5,099 | 5,362 | 5,362 | 5,700 | 6,000 |
| Concord Community Schools (50th percentile) | 4,669 | 4,900 | 5,130 | 5,308 | 5,462 | 5,462 | 5,700 | 6,000 |
| Oxford Area Community Schools (75th percentile) | 5,249 | 5,458 | 5,611 | 5,766 | 5,920 | 5,920 | 6,158 | 6,458 |
| Waverly Community Schools (95th percentile) | 6,998 | 7,159 | 7,312 | 7,467 | 7,621 | 7,621 | 7,743 | 7,914 |
| Bloomfield Hills School District (99th percentile) | 10,294 | 10,454 | 10,607 | 10,762 | 10,916 | 10,916 | 11,091 | 11,335 |

Foundation allowances refer to the base level of per pupil spending. 1994 refers to the academic year 1993-94, and so on. Note that due to court-related problems, foundation allowances did not increase between 1998 and 1999, except marginally for the lowest spending districts.

Table 2: Within-County Inequality in Median Household Incomes and Per Pupil Spending
(Michigan, 1989-90 and 1999-00)

| County | Number of School Districts in the County | Median Income in Richest District as a percentage of Median Income in Poorest District Within County | | Per Pupil Spending in Richest District as a percentage of Per Pupil Spending in Poorest District Within County | |
|---|---|---|---|---|---|
| | | 1990 | 2000 | 1990 | 2000 |
| | (1) | (2) | (3) | (4) | (5) |
| Berrien | 14 | 223 | 203 | 205 | 160 |
| Calhoun | 10 | 172 | 154 | 154 | 109 |
| Genesee | 21 | 293 | 288 | 165 | 121 |
| Ingham | 12 | 187 | 212 | 164 | 136 |
| Jackson | 12 | 144 | 150 | 137 | 104 |
| Kent | 19 | 227 | 229 | 162 | 125 |
| Lenawee | 12 | 185 | 151 | 129 | 122 |
| Macomb | 21 | 233 | 199 | 202 | 152 |
| Muskegon | 12 | 272 | 254 | 162 | 112 |
| Oakland | 28 | 346 | 317 | 249 | 195 |
| Saginaw | 13 | 213 | 205 | 160 | 121 |
| Van Buren | 11 | 283 | 232 | 160 | 149 |
| Washtenaw | 10 | 196 | 226 | 173 | 146 |
| Wayne | 34 | 638 | 499 | 179 | 158 |

While the analysis in this paper includes all K-12 school districts (and counties) in Michigan, for space constraints, this table focuses on a subsample of counties. All 83 counties in Michigan are included in the analysis in the paper; 14 of them have at least 10 K-12 school districts, and are included in this table. For each county, the districts with the highest and the lowest values of median household income are defined as the richest and the poorest districts respectively.

Table 3: Nominal per pupil spending deflated by cost-of-living indices, Michigan school districts, 1993-94

| | Nominal Per Pupil Revenue | Normalized Cost of Living | Real Per Pupil Revenue |
|---|---|---|---|
| Group 1 districts | 4,258 | 99.1 | 4,297 |
| Group 2 districts | 4,607 | 99.8 | 4,616 |
| Group 3 districts | 4,804 | 101.1 | 4,752 |
| Group 4 districts | 5,320 | 103.0 | 5,165 |
| Group 5 districts | 6,809 | 103.1 | 6,604 |

The data on relative costs of living for school districts in Michigan come from Standard and Poor's School Evaluation Services. These indices are constructed so as to adjust for geographic differences in the purchasing power of the dollar that exist across the state, that are due to variations in the cost of living and labor markets.

Table 4: Pre-program Characteristics of Group 1 Michigan Districts - Compared with County Average

| | Group 1 Mean (1) | County Mean (2) | Difference (3) | P-Value (4) |
|---|---|---|---|---|
| Per Pupil Revenues | 4258 | 4544 | -286 | 0.00 |
| Per Pupil Housing Stock | 79419 | 91492 | -12073 | 0.00 |
| Population Density (per mile$^2$) | 83 | 83 | 0 | 0.97 |
| Percent Free Lunch Eligible | 25.60 | 24.27 | 1.33 | 0.14 |
| Math Performance (Standardized) | -0.21 | 0.00 | -0.21 | 0.57 |
| Reading Performance (Standardized) | -0.08 | 0.00 | -0.08 | 0.85 |
| Percent of Housing Units Occupied | 75.26 | 76.81 | -1.54 | 0.09 |
| Percent Owner-Occupied | 79.71 | 77.33 | 2.37 | 0.12 |
| Median Gross Rent | 336.6 | 341.2 | -4.5 | 0.11 |
| Median Household Income | 24239 | 24676 | -437 | 0.15 |
| Civilian Unemployment Rate | 9.62 | 9.29 | 0.33 | 0.13 |
| Percent of Households with PA Income | 9.6 | 9.29 | 0.31 | 0.23 |
| Percent with less than $12^{th}$ Grade | 26.57 | 25.32 | 1.25 | 0.01 |
| Percent with At Least Some College | 32.98 | 35.54 | -2.56 | 0.00 |
| Percent with Bachelor's or More | 9.37 | 10.87 | -1.5 | 0.00 |

Column (1) reports mean statistics of Group 1 districts. Column (2) gives the corresponding mean statistics for the county of a randomly picked Group 1 district. P-values associated with t-tests corresponding to differences between columns (1) and (2).

Table 5: Effect of Proposal A on Per Pupil Revenues

| | Market: CBSA | | Market: 30-mile | |
|---|---|---|---|---|
| | (1) | (2) | (3) | (4) |
| Reform | 434.4*** | 453.6*** | 443.4*** | 450.5*** |
| | (26.0) | (28.0) | (24.5) | (27.1) |
| Reform * t | -35.1*** | -33.4*** | -34.1*** | -31.7*** |
| | (9.5) | (10.4) | (9.1) | (10.4) |
| Group 1 * Reform | -29.7 | -18.6 | -5.4 | 4.3 |
| | (62.7) | (50.6) | (47.5) | (42.7) |
| Group 2 * Reform | -2.4 | 14.1 | -5.6 | 16.3 |
| | (37.1) | (50.1) | (33.4) | (45.6) |
| Group 4 * Reform | 40.7 | 64.1 | 46.1 | 67.6* |
| | (44.2) | (40.6) | (42.6) | (40.0) |
| Group 5 * Reform | -214.8***†† | -143.7*† | -238.4***††† | -140.0*† |
| | (68.9) | (74.1) | (68.9) | (74.2) |
| Group 1 * Reform * t | 154.2*** | 150.1*** | 167.2*** | 159.2*** |
| | (18.3) | (16.8) | (15.5) | (15.0) |
| Group 2 * Reform * t | 64.3*** | 65.1*** | 66.4*** | 61.6*** |
| | (14.1) | (17.4) | (13.6) | (16.3) |
| Group 4 * Reform * t | -18.0 | 9.0 | -23.3 | 7.1 |
| | (14.9) | (20.6) | (14.2) | (20.9) |
| Group 5 * Reform * t | -86.0***††† | -83.8***††† | -76.0***††† | -83.3***††† |
| | (22.3) | (19.2) | (22.4) | (19.2) |
| Observations | 4810 | 4810 | 5664 | 5664 |
| $R^2$ | 0.83 | 0.78 | 0.84 | 0.80 |
| Weighted | N | Y | N | Y |

*, **, ***: significant at the 10, 5, and 1 percent level, respectively. †, ††, †††: Group 5 coefficient statistically different from corresponding Group 1 coefficient at the 10, 5, and 1 percent level, respectively. Robust standard errors adjusted for clustering by district are in parentheses. All regressions include time trend, group dummies, interactions of time trend with group dummies, and market fixed effects. See specification (1) of text. Group 3, the middle quintile of districts in the pre-reform spending distribution, is the omitted category.

Table 6: Effect of Proposal A on Per Pupil Housing Stock

| | Market: CBSA | | Market: 30-mile | |
|---|---|---|---|---|
| | (1) | (2) | (3) | (4) |
| Reform | -3871*** | -3918*** | -3918*** | -4204*** |
| | (404) | (464) | (393) | (467) |
| Reform * t | 840*** | 883*** | 949*** | 877*** |
| | (261) | (317) | (244) | (319) |
| Group 1 * Reform | 2077** | 2087* | 2034*** | 2023** |
| | (905) | (1070) | (699) | (891) |
| Group 2 * Reform | 396 | 98 | 1100* | 834 |
| | (660) | (860) | (608) | (790) |
| Group 4 * Reform | -2889*** | -3218*** | -2402*** | -2917*** |
| | (825) | (1046) | (865) | (1010) |
| Group 5 * Reform | -9781***††† | -7892***††† | -14140***††† | -7726***††† |
| | (1683) | (2239) | (4662) | (2230) |
| Group 1 * Reform * t | 739** | 406 | 821** | 512 |
| | (360) | (385) | (328) | (371) |
| Group 2 * Reform * t | 140 | 180 | 256 | 197 |
| | (378) | (480) | (357) | (442) |
| Group 4 * Reform * t | -1051** | 259 | -1228** | 182 |
| | (464) | (566) | (484) | (560) |
| Group 5 * Reform * t | -2527***††† | -1442*†† | -3216***††† | -1379†† |
| | (669) | (855) | (989) | (852) |
| Observations | 4810 | 4810 | 5664 | 5664 |
| $R^2$ | 0.49 | 0.45 | 0.45 | 0.45 |
| Weighted | N | Y | N | Y |

Table 7: Effect of Proposal A on Enrollment Share

| | Market: CBSA | Market: 30-mile |
|---|---|---|
| | (1) | (2) |
| Group 1 * Reform | 0.003* | 0.002** |
| | (0.002) | (0.001) |
| Group 2 * Reform | -0.001 | -0.001 |
| | (0.001) | (0.001) |
| Group 4 * Reform | 0.002 | 0.003 |
| | (0.003) | (0.003) |
| Group 5 * Reform | -0.000 | -0.000 |
| | (0.002) | (0.002) |
| Group 1 * Reform * t | 0.001 | 0.001* |
| | (0.001) | (0.001) |
| Group 2 * Reform * t | -0.001 | -0.001 |
| | (0.001) | (0.001) |
| Group 4 * Reform * t | -0.000 | 0.000 |
| | (0.001) | (0.001) |
| Group 5 * Reform * t | -0.001* | -0.001* |
| | (0.001) | (0.001) |
| Observations | 4810 | 5662 |
| $R^2$ | 0.07 | 0.09 |

Footnote for Tables 6 and 7: *, **, ***: significant at the 10, 5, and 1 percent level, respectively. †, ††, †††: Group 5 coefficient statistically different from corresponding Group 1 coefficient at the 10, 5, and 1 percent level, respectively. Robust standard errors adjusted for clustering by district are in parentheses. All regressions include time trend, group dummies, interactions of time trend with group dummies, and market fixed effects. See specification (1) of text. Group 3, the middle quintile of districts in the pre-reform spending distribution, is the omitted category.

Table 8: Effect of Proposal A on Housing and Income, Michigan School Districts
(1980, 1990, and 2000 Censuses)

| Panel A | Percentage of Housing Units Occupied | | Percentage of Housing Units Owner-Occupied | | Median Gross Rent | |
|---|---|---|---|---|---|---|
| | CBSA | 30-mile | CBSA | 30-mile | CBSA | 30-mile |
| | (1) | (2) | (3) | (4) | (5) | (6) |
| Reform * t | 0.87 | 2.15*** | 3.27*** | 3.10*** | -29.81*** | -28.53*** |
| | (0.60) | (0.72) | (0.43) | (0.35) | (5.39) | (5.37) |
| Group 1 * Reform * t | 5.22*** | 6.01*** | 1.40 | 1.91** | 8.76 | 12.35 |
| | (1.68) | (1.66) | (0.98) | (0.77) | (9.23) | (8.04) |
| Group 2 * Reform * t | 2.23** | 1.94* | 0.74 | 1.07** | -1.61 | -2.13 |
| | (0.97) | (1.06) | (0.63) | (0.53) | (7.56) | (7.23) |
| Group 4 * Reform * t | -0.78 | -1.83** | 1.31 | 1.50* | -29.54*** | -30.42*** |
| | (0.64) | (0.78) | (0.90) | (0.85) | (8.56) | (8.41) |
| Group 5 * Reform * t | 0.69†† | -0.47††† | 0.78 | 0.95 | -51.18***††† | -52.31***††† |
| | (0.70) | (0.81) | (0.69) | (0.64) | (7.86) | (7.83) |
| Observations | 1198 | 1411 | 1195 | 1403 | 1200 | 1413 |
| $R^2$ | 0.41 | 0.49 | 0.27 | 0.27 | 0.81 | 0.81 |

| Panel B | Median Household Income | | Percentage of Households with PA Income | | Civilian Unemployment Rate | |
|---|---|---|---|---|---|---|
| | CBSA | 30-mile | CBSA | 30-mile | CBSA | 30-mile |
| | (1) | (2) | (3) | (4) | (5) | (6) |
| Reform * t | 1856.65*** | 1907.53*** | -8.41*** | -8.48*** | -3.27*** | -3.45*** |
| | (536.08) | (525.42) | (0.65) | (0.61) | (0.39) | (0.41) |
| Group 1 * Reform * t | 1923.24 | 2310.81** | -0.80 | -2.08** | -1.37* | -2.03*** |
| | (1274.76) | (1035.53) | (0.88) | (0.82) | (0.79) | (0.70) |
| Group 2 * Reform * t | -247.32 | 20.53 | 0.56 | 0.27 | 0.22 | -0.12 |
| | (671.33) | (643.99) | (1.20) | (1.07) | (0.73) | (0.71) |
| Group 4 * Reform * t | 419.93 | 416.40 | -6.94 | -6.84 | -3.60 | -3.42 |
| | (1365.69) | (1338.31) | (4.48) | (4.43) | (3.05) | (3.01) |
| Group 5 * Reform * t | -2560.79***††† | -2618.47***††† | 1.67 | 1.84†† | 0.70† | 0.91†† |
| | (788.74) | (779.27) | (1.43) | (1.40) | (0.75) | (0.75) |
| Observations | 1198 | 1411 | 1197 | 1409 | 1198 | 1411 |
| $R^2$ | 0.60 | 0.61 | 0.40 | 0.44 | 0.33 | 0.36 |

*, **, ***: significant at the 10, 5, and 1 percent level, respectively. †, ††, †††: Group 5 coefficient statistically different from corresponding Group 1 coefficient at the 10, 5, and 1 percent level, respectively. Robust standard errors adjusted for clustering by district are in parentheses. All regressions include a time trend, group dummies, interactions of group dummies with time trend, market fixed effects, and are weighted by the population of the school district. See specification (3) in the text. Group 3, the middle quintile of districts in the pre-reform spending distribution, is the omitted category.

Table 9: Effect of Proposal A on Educational Attainment, Michigan School Districts
(1980, 1990, and 2000 Censuses)

| Panel C | Percentage with less than $12^{th}$ Grade | | Percentage with at least some college | | Percentage with at least a Bachelor's Degree | |
|---|---|---|---|---|---|---|
| | CBSA | 30-mile | CBSA | 30-mile | CBSA | 30-mile |
| | (1) | (2) | (3) | (4) | (5) | (6) |
| Reform * t | 3.44*** | 3.40*** | -8.51*** | -8.06*** | 2.99*** | 3.03*** |
| | (0.39) | (0.40) | (0.57) | (0.59) | (0.33) | (0.33) |
| Group 1 * Reform * t | -0.48 | -0.98 | 2.14* | 2.77*** | 0.10 | -0.14 |
| | (0.67) | (0.62) | (1.11) | (1.01) | (0.71) | (0.59) |
| Group 2 * Reform * t | 0.29 | 0.11 | 0.51 | 0.87 | 0.55 | 0.49 |
| | (0.61) | (0.61) | (1.13) | (1.07) | (0.56) | (0.53) |
| Group 4 * Reform * t | 0.54 | 0.54 | -1.42 | -1.81* | -0.08 | -0.12 |
| | (0.82) | (0.82) | (1.02) | (1.02) | (0.71) | (0.70) |
| Group 5 * Reform * t | 0.27 | 0.23 | -1.64**††† | -1.99***††† | 1.10 | 1.15 |
| | (0.51) | (0.52) | (0.73) | (0.76) | (1.17) | (1.19) |
| Observations | 1194 | 1405 | 1194 | 1405 | 1194 | 1405 |
| $R^2$ | 0.47 | 0.51 | 0.53 | 0.54 | 0.39 | 0.38 |

*, **, ***: significant at the 10, 5, and 1 percent level, respectively. †, ††, †††: Group 5 coefficient statistically different from corresponding Group 1 coefficient at the 10, 5, and 1 percent level, respectively. Robust standard errors adjusted for clustering by district are in parentheses. All regressions include a time trend, group dummies, interactions of group dummies with time trend, market fixed effects, and are weighted by the population of the school district. See specification (3) in the text. Group 3, the middle quintile of districts in the pre-reform spending distribution, is the omitted category.

Table 10: Within-district Heterogeneity in Educational Attainment and Household Income
(Michigan School Districts, 1990 and 2000 Censuses)

| | Educational Attainment | | Household Income | |
|---|---|---|---|---|
| | 1990 | 2000 | 1990 | 2000 |
| Group 1 | 0.700 | 0.704 | 0.893 | 0.918 |
| Group 2 | 0.701 | 0.703 | 0.901 | 0.914 |
| Group 3 | 0.707 | 0.706 | 0.906 | 0.917 |
| Group 4 | 0.716 | 0.719 | 0.888 | 0.913 |
| Group 5 | 0.699 | 0.679 | 0.908 | 0.912 |

The measure of dispersion used here is defined as one minus the Herfindahl index, see text for details. All figures are weighted by the number of persons in the district in 1990.

Table 11: Effect of Proposal A on Within-district Heterogeneity in Educational Attainment and Household Income (Michigan School Districts, 1990 and 2000 Censuses)

| Panel A | Household Income | | | |
|---|---|---|---|---|
| Market: | CBSA | | 30-mile | |
| | (1) | (2) | (3) | (4) |
| Year 2000 Dummy | 0.01*** | 0.02*** | 0.01*** | 0.02*** |
| | (0.00) | (0.00) | (0.00) | (0.00) |
| Group 1 * Yr 2000 | 0.01*** | 0.00 | 0.01*** | 0.00* |
| | (0.00) | (0.00) | (0.00) | (0.00) |
| Group 2 * Yr 2000 | 0.00 | -0.00* | 0.00 | -0.00 |
| | (0.00) | (0.00) | (0.00) | (0.00) |
| Group 4 * Yr 2000 | -0.00** | -0.00 | -0.00*** | -0.00 |
| | (0.00) | (0.00) | (0.00) | (0.00) |
| Group 5 * Yr 2000 | -0.00*††† | -0.00 | -0.01**††† | -0.00††† |
| | (0.00) | (0.00) | (0.00) | (0.00) |
| Observations | 800 | 798 | 942 | 940 |
| $R^2$ | 0.17 | 0.16 | 0.26 | 0.19 |
| Weighted | N | Y | N | Y |

| Panel B | Educational Attainment | | | |
|---|---|---|---|---|
| Market: | CBSA | | 30-mile | |
| | (1) | (2) | (3) | (4) |
| Year 2000 Dummy | 0.00 | -0.00 | 0.00 | -0.00 |
| | (0.00) | (0.00) | (0.00) | (0.00) |
| Group 1 * Yr 2000 | 0.00 | 0.01 | 0.00 | 0.01 |
| | (0.00) | (0.00) | (0.00) | (0.01) |
| Group 2 * Yr 2000 | -0.00 | -0.00 | -0.00 | -0.00 |
| | (0.00) | (0.00) | (0.00) | (0.00) |
| Group 4 * Yr 2000 | 0.01 | 0.01 | 0.01 | 0.01 |
| | (0.01) | (0.01) | (0.01) | (0.01) |
| Group 5 * Yr 2000 | -0.02**††† | -0.02***††† | -0.02**††† | -0.03***††† |
| | (0.01) | (0.01) | (0.01) | (0.01) |
| Observations | 800 | 800 | 942 | 942 |
| $R^2$ | 0.12 | 0.23 | 0.11 | 0.18 |
| Weighted | N | Y | N | Y |

The dependent variable is the measure of dispersion defined as one minus the Herfindahl index, see text for details. Group 3, the middle quintile of districts in the pre-reform spending distribution, is the omitted category. The regressions in the even numbered columns are weighted by the number of persons in the district in 1990. As noted in footnote 17, the income categories in the 1980 census were different from those in the 1990 and 2000 censuses (in terms of the ranges of the respective bins). Since use of the Herfindahl index-based measure of dispersion requires consistent categories (across years) for comparison, this precluded use of income data from the 1980 census in these calculations. So the intra-district analysis includes data from the 1990 and 2000 censuses only. The results for educational attainment are similar if we include data from the 1980 census. *, **, *** denote significance at the 10, 5, and 1 percent level, respectively. †, ††, †††: Group 5 coefficient statistically different from corresponding Group 1 coefficient at the 10, 5, and 1 percent level, respectively. Robust standard errors adjusted for clustering by district are in parentheses. All regressions include market fixed effects.

Table 12: Effect of Proposal A on Housing, Income, and Educational Attainment in Michigan Relative to Neighboring Ohio (1980, 1990, and 2000 Censuses)

| | Percentage of Housing Units Occupied | | Median Gross Rent | | Median Household Income | | Percentage with less than $12^{th}$ Grade | |
|---|---|---|---|---|---|---|---|---|
| | CBSA | 30-mile | CBSA | 30-mile | CBSA | 30-mile | CBSA | 30-mile |
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
| Reform * t | -0.15 | -0.11 | -20.47*** | -18.57*** | 940.52** | 992.83** | 3.85*** | 3.78*** |
| | (0.34) | (0.33) | (6.57) | (6.41) | (462.96) | (449.01) | (0.30) | (0.30) |
| Reform * t * MI | 1.02 | 2.26*** | -9.35 | -9.96 | 916.14 | 914.70 | -0.41 | -0.39 |
| | (0.69) | (0.79) | (8.50) | (8.36) | (707.80) | (690.92) | (0.49) | (0.50) |
| Group 1 * Reform * t | -0.13 | 0.01 | 7.28 | 8.68 | 950.74 | 1096.56 | 0.19 | 0.19 |
| | (0.55) | (0.52) | (9.23) | (8.59) | (722.19) | (747.45) | (0.58) | (0.54) |
| Group 2 * Reform * t | -0.57 | -0.63 | 13.42 | 15.41* | 445.40 | 822.83 | 0.44 | 0.21 |
| | (0.50) | (0.50) | (8.28) | (7.97) | (613.05) | (600.78) | (0.58) | (0.58) |
| Group 4 * Reform * t | -0.49 | -0.38 | -2.59 | -3.21 | 109.73 | 155.04 | 0.17 | 0.14 |
| | (0.51) | (0.50) | (8.24) | (8.10) | (629.59) | (617.84) | (0.48) | (0.46) |
| Group 5 * Reform * t | -0.23 | -0.30 | -10.98 | -10.73†† | -1013.29 | -1178.64 | 0.82 | 0.89 |
| | (0.50) | (0.50) | (9.19) | (9.29) | (711.50) | (730.69) | (0.76) | (0.80) |
| Group 1 * Reform * t * MI | 5.35*** | 6.00*** | 1.48 | 3.66 | 972.49 | 1214.25 | -0.67 | -1.17 |
| | (1.77) | (1.74) | (13.05) | (11.76) | (1463.70) | (1220.30) | (0.89) | (0.82) |
| Group 2 * Reform * t * MI | 2.80** | 2.56** | -15.04† | -17.54†† | -692.72 | -802.30† | -0.15 | -0.10 |
| | (1.09) | (1.18) | (11.20) | (10.80) | (908.49) | (889.80) | (0.84) | (0.84) |
| Group 4 * Reform * t * MI | -0.29††† | -1.45††† | -26.95**†† | -27.21**††† | 310.20 | 261.36 | 0.37 | 0.39 |
| | (0.82) | (0.93) | (11.87) | (11.67) | (1502.25) | (1473.36) | (0.95) | (0.94) |
| Group 5 * Reform * t * MI | 0.92††† | -0.17††† | -40.19***††† | -41.59***††† | -1547.50*† | -1439.82*† | -0.55 | -0.66 |
| | (0.86) | (0.96) | (12.08) | (12.14) | (927.23) | (862.15) | (0.91) | (0.96) |
| Observations | 2811 | 3205 | 2813 | 3207 | 2811 | 3205 | 2807 | 3199 |
| $R^2$ | 0.36 | 0.45 | 0.79 | 0.80 | 0.59 | 0.62 | 0.44 | 0.48 |

*, **, ***: significant at the 10, 5, and 1 percent level, respectively. †, ††, †††: statistically different from Group 1 coefficient at the 10, 5, and 1 percent level, respectively. Robust standard errors adjusted for clustering by district are in parentheses. All regressions include Michigan dummy, time trend, interaction of Michigan dummy with time trend, group dummies, interactions of group dummies with time trend, interactions of Michigan dummy with group dummies, interactions of Michigan dummy with group dummies and time trend, market fixed effects, and are weighted by the population of the school district. See specification (5) in the text. Group 3, the middle quintile of districts in the pre-reform spending distribution, is the omitted category.

Table 13: Were there Differential Changes in Private School Enrollment?
(1980, 1990, and 2000 Censuses)

| Dependent Variable: Private School Enrollment | | | | |
|---|---|---|---|---|
| | Market: CBSA | | Market: 30-mile | |
| | (1) | (2) | (3) | (4) |
| Year 2000 Dummy | -0.56 | -1.59** | -0.27 | -0.72 |
| | (0.49) | (0.66) | (0.47) | (0.59) |
| Group 1 * Yr 2000 | 0.66 | 0.38 | 0.44 | 0.59 |
| | (0.74) | (1.21) | (0.70) | (1.03) |
| Group 2 * Yr 2000 | -0.78 | -1.44 | 0.15 | -0.28 |
| | (0.71) | (0.94) | (0.69) | (0.78) |
| Group 4 * Yr 2000 | 0.86 | 0.30 | 0.48 | -1.01 |
| | (0.66) | (1.04) | (0.65) | (0.98) |
| Group 5 * Yr 2000 | 1.05 | 1.62 | 0.75 | 1.25 |
| | (0.82) | (0.99) | (0.82) | (0.89) |
| Observations | 798 | 798 | 938 | 938 |
| $R^2$ | 0.28 | 0.27 | 0.30 | 0.35 |
| Weighted | N | Y | N | Y |

*, **, ***: significant at the 10, 5, and 1 percent level, respectively. Robust standard errors adjusted for clustering by district. The dependent variable is the percentage of enrolled students in a school district who attends private schools. All regressions include market fixed effects.

Table 14: Assessing the Role of the Decline in Manufacturing Industry as a Potential Confounding Factor
(1980, 1990, and 2000 Censuses)

| Dependent Variable: Percent of population employed in Manufacturing Sector | | | | |
|---|---|---|---|---|
| | Market: CBSA | | Market: 30-mile | |
| | (1) | (2) | (3) | (4) |
| Reform * t | 2.15*** | 2.74*** | 2.23*** | 2.80*** |
| | (0.57) | (0.66) | (0.59) | (0.65) |
| Group 1 * Reform * t | -0.08 | -0.80 | -0.42 | -1.04 |
| | (0.86) | (0.88) | (0.81) | (0.84) |
| Group 2 * Reform * t | -0.67 | -1.14 | -1.12 | -1.38 |
| | (0.90) | (0.93) | (0.87) | (0.89) |
| Group 4 * Reform * t | 0.46 | 1.36 | 0.07 | 1.51 |
| | (0.77) | (0.93) | (0.77) | (0.97) |
| Group 5 * Reform * t | 1.27 | 1.17 | 0.98 | 1.11 |
| | (0.79) | (0.80) | (0.81) | (0.80) |
| Observations | 1196 | 1193 | 1406 | 1403 |
| $R^2$ | 0.69 | 0.63 | 0.62 | 0.56 |
| Weighted | N | Y | N | Y |

*, **, ***: significant at the 10, 5, and 1 percent level, respectively. Robust standard errors adjusted for clustering by district are in parentheses. All regressions include a time trend, group dummies, interactions of group dummies with time trend, market fixed effects, and are weighted by the population of the school district. See specification (3) in the text. Group 3, the middle quintile of districts in the pre-reform spending distribution, is the omitted category.

Table A1: Effect of Proposal A on Per Pupil Revenues and Housing Stock

| | Per Pupil Revenues | | | | Per Pupil Housing Stock | | | |
|---|---|---|---|---|---|---|---|---|
| | Market: CBSA | | Market: 20-mile | | Market: CBSA | | Market: 20-mile | |
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
| Trend (t) | 267.0*** | 258.8*** | 270.6*** | 261.0*** | 4593.8*** | 5274.6*** | 4419.0*** | 5106.7*** |
| | (8.6) | (9.7) | (7.9) | (7.8) | (215.6) | (275.4) | (208.1) | (290.1) |
| Group 1 * t | -46.2*** | -44.0*** | -55.2*** | -49.5*** | -753.5** | -968.0** | -687.8** | -891.7** |
| | (12.9) | (12.9) | (11.2) | (10.8) | (339.9) | (381.2) | (303.2) | (374.7) |
| Group 2 * t | -16.6 | -15.7 | -18.0* | -13.9 | -189.1 | -437.8 | 4.1 | -399.0 |
| | (11.3) | (13.9) | (10.7) | (12.0) | (357.6) | (389.6) | (329.4) | (377.5) |
| Group 4 * t | 19.4 | 32.1** | 14.7 | 29.7** | 1986.9*** | -77.4 | 2378.6*** | 29.9 |
| | (12.0) | (15.7) | (11.5) | (14.6) | (432.7) | (1321.3) | (477.4) | (1322.4) |
| Group 5 * t | 86.9***††† | 89.2***††† | 72.4***††† | 83.6***††† | 5029.2***††† | 3251.6***††† | 5073.9***††† | 3442.4***††† |
| | (20.1) | (18.1) | (23.1) | (18.5) | (912.6) | (733.3) | (1102.2) | (855.3) |
| Reform | 434.4*** | 453.6*** | 426.3*** | 430.3*** | -3870.5*** | -3917.9*** | -3524.3*** | -3703.4*** |
| | (26.0) | (28.0) | (23.3) | (22.5) | (403.9) | (463.7) | (378.9) | (436.5) |
| Group 1 * Reform | -29.7 | -18.6 | 11.8 | 25.2 | 2076.8** | 2086.7* | 1768.3** | 1583.6* |
| | (62.7) | (50.6) | (51.4) | (43.1) | (905.2) | (1070.3) | (745.0) | (951.9) |
| Group 2 * Reform | -2.4 | 14.1 | 14.7 | 37.4 | 396.3 | 98.3 | 712.3 | 347.6 |
| | (37.1) | (50.1) | (33.0) | (44.3) | (660.1) | (860.3) | (615.6) | (812.3) |
| Group 4 * Reform | 40.7 | 64.1 | 60.5 | 90.5** | -2889.3*** | -3218.5*** | -2449.0*** | -3231.7*** |
| | (44.2) | (40.6) | (43.3) | (37.0) | (825.1) | (1046.4) | (866.1) | (1015.1) |
| Group 5 * Reform | -214.8***†† | -143.7* | -278.3***††† | -166.0*† | -9781.3***††† | -7892.4***††† | -11438.3***††† | -10691.0***††† |
| | (68.9) | (74.1) | (79.8) | (89.6) | (1682.8) | (2238.7) | (2021.0) | (2570.1) |
| Reform * t | -35.1*** | -33.4*** | -36.6*** | -34.7*** | 840.2*** | 882.5*** | 1003.1*** | 1098.6*** |
| | (9.5) | (10.4) | (9.5) | (9.1) | (261.0) | (316.8) | (243.4) | (307.4) |
| Group 1 * Reform * t | 154.2*** | 150.1*** | 162.2*** | 156.5*** | 738.8** | 405.6 | 765.4** | 270.1 |
| | (18.3) | (16.8) | (15.9) | (14.7) | (360.4) | (384.9) | (335.4) | (371.4) |
| Group 2 * Reform * t | 64.3*** | 65.1*** | 65.2*** | 63.0*** | 140.0 | 179.8 | 191.4 | 63.4 |
| | (14.1) | (17.4) | (13.8) | (15.9) | (377.9) | (480.2) | (364.3) | (449.8) |
| Group 4 * Reform * t | -18.0 | 9.0 | -16.3 | 12.5 | -1051.5** | 259.5 | -1187.8** | 143.3 |
| | (14.9) | (20.6) | (14.8) | (20.3) | (464.3) | (566.2) | (460.5) | (542.0) |
| Group 5 * Reform * t | -86.0***††† | -83.8***††† | -68.2***††† | -77.5***††† | -2527.0***††† | -1441.8*†† | -2049.8***††† | -700.3 |
| | (22.3) | (19.2) | (25.1) | (22.0) | (669.2) | (855.2) | (775.7) | (815.4) |
| Observations | 4810 | 4810 | 4908 | 4908 | 4810 | 4810 | 4908 | 4908 |
| $R^2$ | 0.83 | 0.78 | 0.85 | 0.80 | 0.49 | 0.45 | 0.49 | 0.47 |
| Weighted | N | Y | N | Y | N | Y | N | Y |

*, **, ***: significant at the 10, 5, and 1 percent level, respectively. †, ††, †††: Group 5 coefficient statistically different from corresponding Group 1 coefficient at the 10, 5, and 1 percent level, respectively. Robust standard errors adjusted for clustering by district are in parentheses. All regressions include group dummies, and market fixed effects. Group 3, the middle quintile of districts in the pre-reform spending distribution, is the omitted category.

**Figure 1: Michigan MSAs**

Note: Black lines, colors, and labels demarcate MSAs; grey lines indicate school district boundaries.

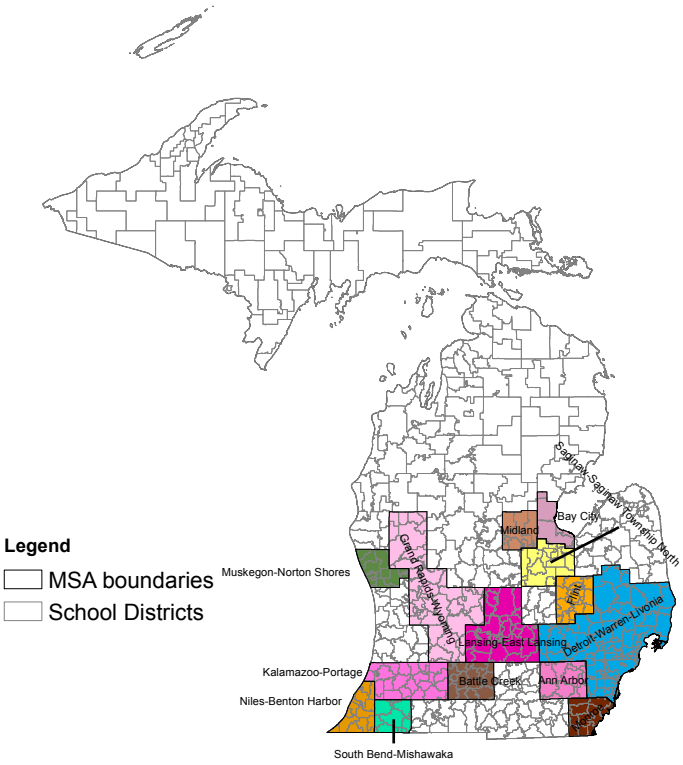



**Figure 2: Michigan CBSAs**

Note: Black lines, colors, and labels demarcate CBSAs; grey lines indicate school district boundaries.

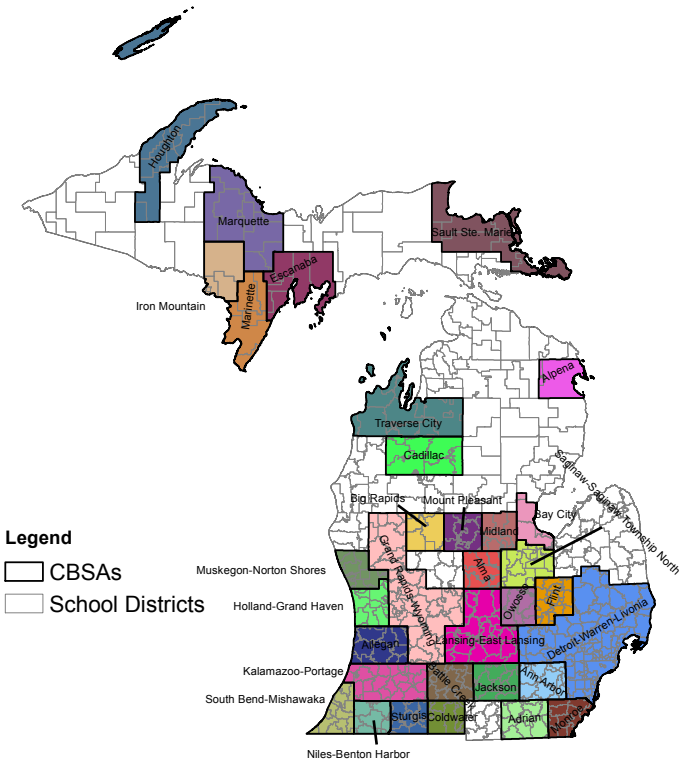


**Figure 3: Relationship between Per Pupil Spending and Household Income in the pre-program period (1993-94)**

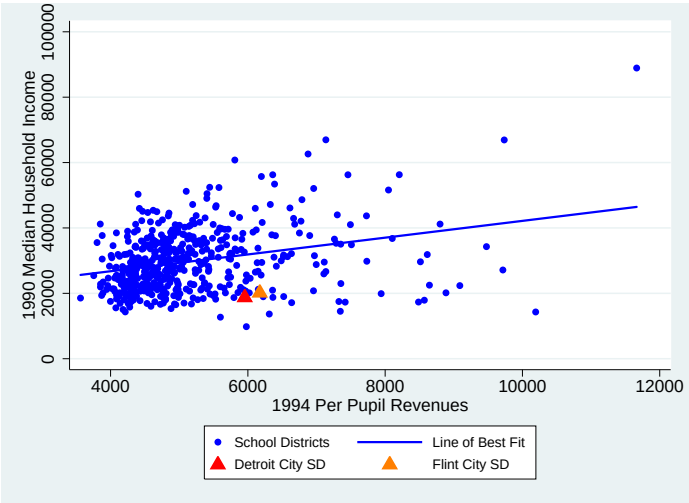



**Figure 4: Distribution of Per Pupil Revenues across Districts in the Lowest Spending Group Compared to that in the Highest Spending Group, 1994 and 2001**

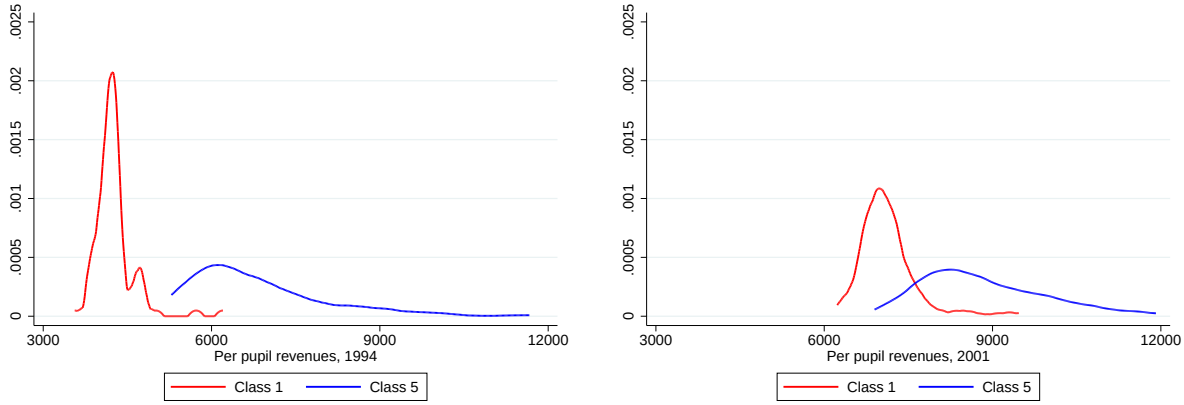
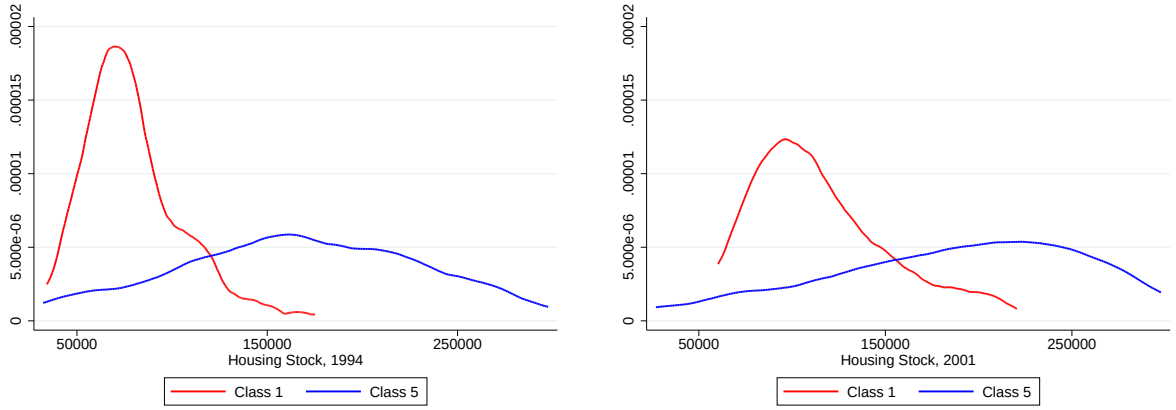


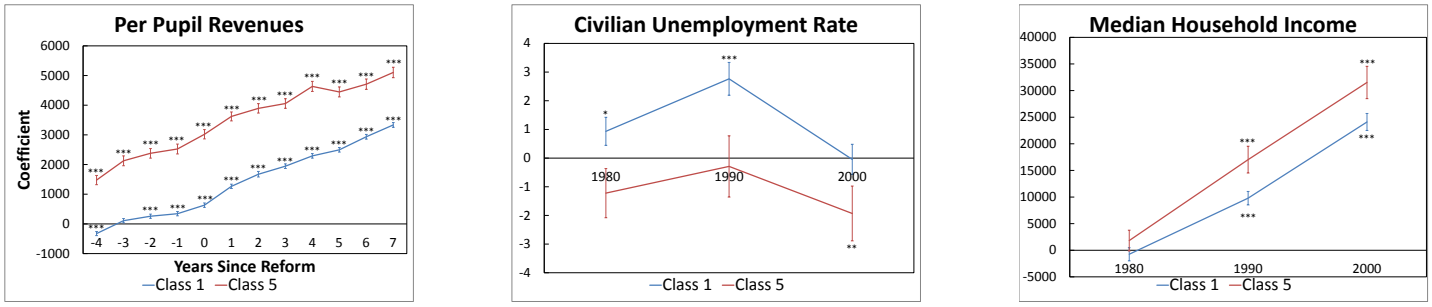

**Figure 5: Distribution of Per Capita Housing Stock across Districts in the Lowest Spending Group Compared to that in the Highest Spending Group, 1994 and 2001**




Notes to Figures 4-5: Districts are divided into quintiles based on spending in 1993-94. The lowest spending group (Class 1) corresponds to the bottom quintile, and the highest spending group (Class 5) is the top quintile.

**Figure 6: CBSA as Market - Coefficient and standard error plots for specifications (2) and (4)**

(A) (B) (C)




(D) (E) (F)

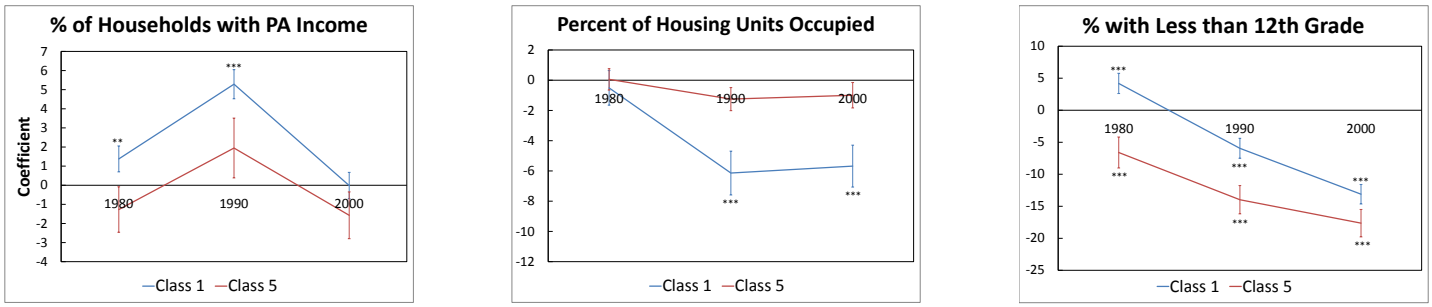
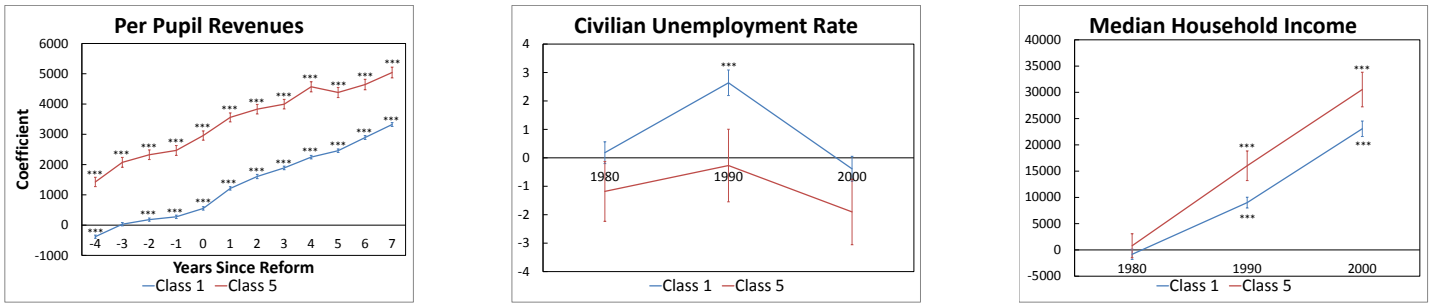
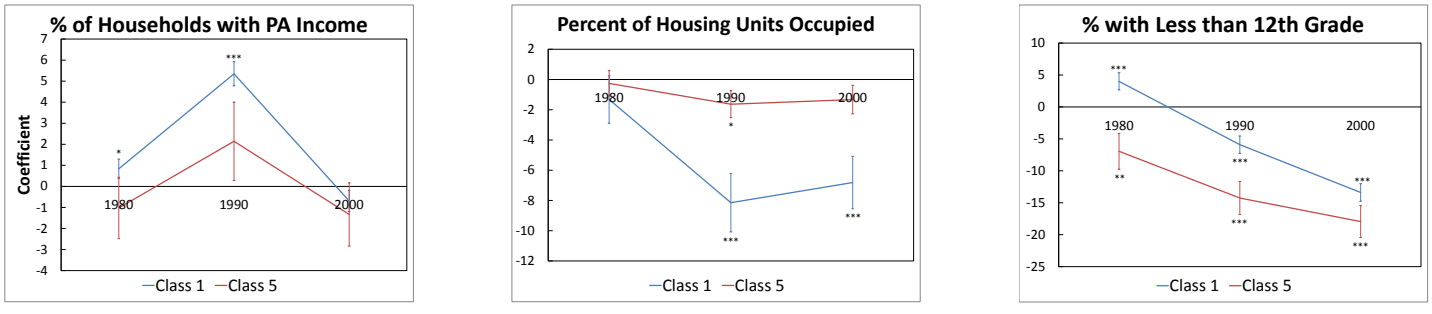



**Figure 7: 30-mile radius around CBSA centroid as Market - Coefficient and standard error plots for specifications (2) and (4)**

(A) (B) (C)




(D) (E) (F)




Note to Figures 6 and 7: Standard Error bars shown. ***, **, * indicate coefficient significant at 1%, 5%, and 10% level respectively.

**Figure 8: Relationship between change in per pupil spending and change in test performance**

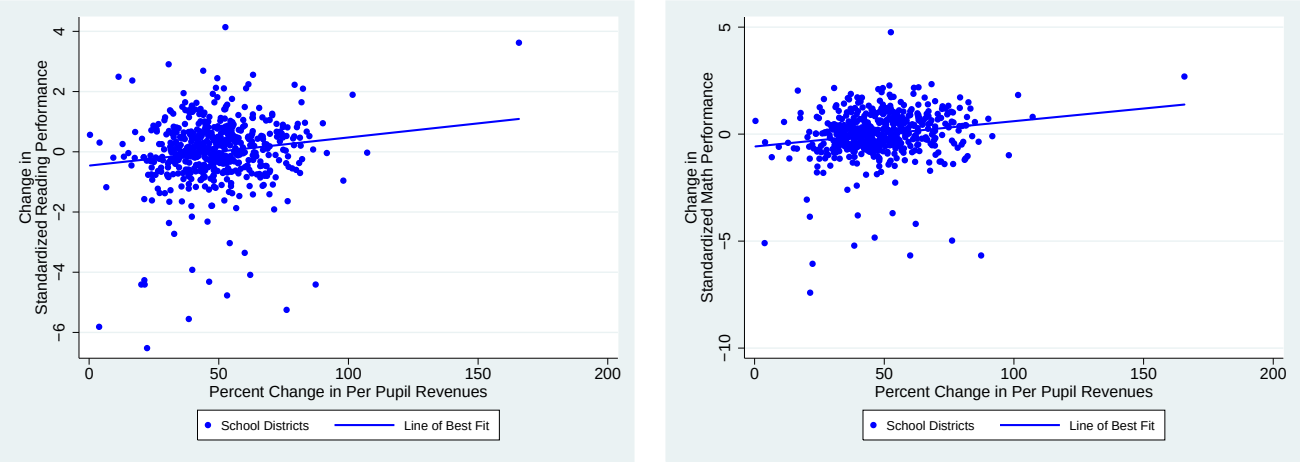
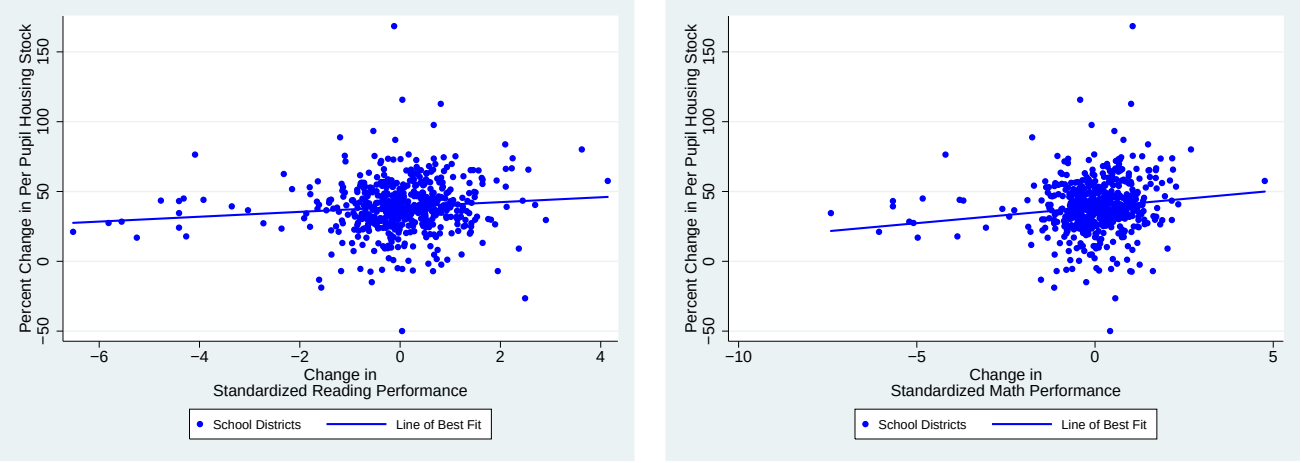



**Figure 9: Relationship between change in per pupil housing stock and change in test performance**




Note for Figures 8 and 9: Change considered is change between 1994 and 2001 for each variable.

**Figure A1: Michigan CBSAs and 20-mile radii around CBSA Centroids**

Note: Black lines, colors, and labels demarcate CBSAs.
Black circles indicate 20-mile radius around CBSA Centroid. Grey lines indicate school districts

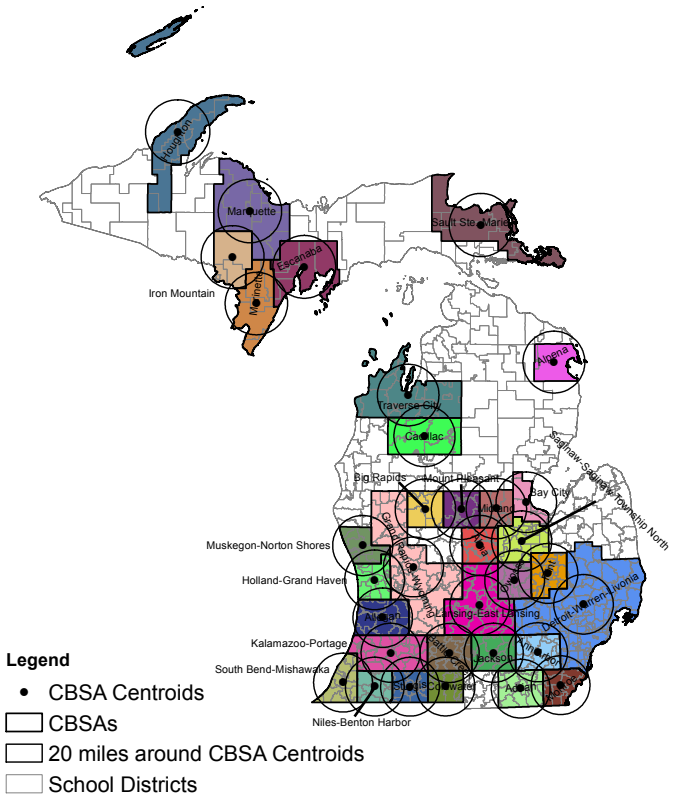



**Figure A2: Michigan CBSAs and Counties**

Note: Colors and labels demarcate CBSAs.
Black lines demarcate County Lines. Grey lines indicate school districts

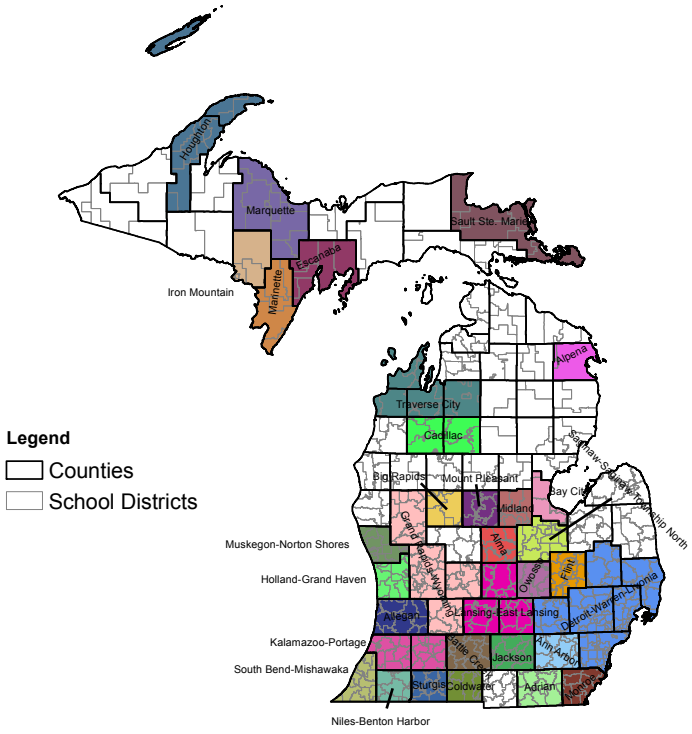


**Figure A3: Distribution of School Districts by Spending Overlaid on CBSA boundaries**

Note: Black lines and labels demarcate CBSAs. District Classification based on quintiles of 1994 spending