The Impact of School Finance Litigation on Resource Distribution: A Comparison of Court-Mandated Equity and Adequacy Reforms

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Abstract

While there is a wealth of research on school finance equity and adequacy, and school finance theory clearly documents differences between the two concepts, no study has examined whether the reforms engendered by each approach actually differ in terms of resource distribution. This study examines the issues using district level data on expenditure by function from two, large national datasets: U.S Census of Governments School System Finance File (F-33, 1972-2002) and the National Center for Education Statistics' Longitudinal School District Fiscal-Nonfiscal File (FNF, 1990-2000). A difference-in-differences estimator with state and year fixed effects indicates that both court-mandated equity and adequacy reforms decrease resource inequities. However, estimates based on data from the F-33 file show negligible differences between equity and adequacy reforms, while estimates based on data from the FNF file indicate adequacy reform does not decrease horizontal inequities as much as court-mandated equity reform. To examine these contradictory findings, we implement a two-stage regression approach to examine if court-mandated adequacy reform is associated with a state funding mechanism accounting for certain educational needs of students. Court-mandated adequacy reform does not result in the allocation of additional resources to low income districts when compared to states under court-mandated equity reform. We conclude that, contrary to school finance theory, resource distribution patterns following court-mandated equity and adequacy reforms are not statistically different.

Introduction

Equity and adequacy are the two most prominent principles in school finance policy. In its broadest sense, school finance equity specifies that equally situated children should be treated equally. School finance adequacy, in contrast, prescribes that the level of educational resources made available be sufficient to provide all students opportunity to reach, at a minimum, a state-standard level of proficiency. Operationally speaking, equity refers to fairness in the distribution of educational goods and services while adequacy means that the allocation of resources should vary according to certain educational needs of students so schools can respond to those student's needs.

Both legal derivatives of the United States Constitution and state equal protection clauses, equity and adequacy arguably have influenced state public education systems more than any other reform in the last three decades. By way of example, 36 states have had the constitutionality of their funding mechanism challenged on equity grounds and 37 states their school funding mechanism on adequacy grounds since California's *Serrano v. Priest* (1971) and Kentucky's *Rose v. Council for Better Education* (1989), respectively. Of the more than 125 plaintiff filed lawsuits, state funding mechanisms have been overturned by state courts on more than 50 occasions as of 2005.[1]

While there is a wealth of research on various aspects of school finance equity and adequacy and substantive debate on the differences between the two concepts, no one has asked, until now, whether the reforms engendered by each approach actually differ in terms of resource distribution. Although research clearly documents that court-mandated finance reform has lead

1. As noted in Guthrie and Springer (2006), legal challenges to state funding mechanisms are not one-off endeavors. Arizona, California, Connecticut, Kansas, New Hampshire, New Jersey, New York, Ohio, Pennsylvania, Texas, and Wyoming are states in which there have been not one, not two, but as many as eight state supreme court rulings overturning school finance system.

to greater spending on education (Murray, Evans, and Schwab, 1998; Card and Payne, 2002; Hoxby, 2001; Baiker and Gordon, 2006),[2] it is unclear if greater spending has benefited students requiring additional resources or found all districts in a state spending more. If it is the latter, in practice then the distribution of resources following a court-mandated adequacy reform might not look fundamentally different from the distribution of resources after an equity mandate.

Our study begins to bridge this knowledge gap by examining the impact of court-mandated school finance reform on resource distribution and whether differences exist in court-mandated finance reforms that are based on equity versus adequacy justifications. We focus on court-mandated reform since the legal system has been the primary driver of school finance reform for more than three decades, during which lawsuits challenging the constitutionality of a state funding mechanism have been filed in 45 of 50 states.[3] Within this context, our study addresses two questions:

1. What is the impact of court-mandated school finance reform on resource distribution?
2. Do different resource distribution patterns emerge following court-mandated equity and adequacy reforms?

Our study uses district level data on expenditure by function drawn from two, large national datasets: the U.S. Census of Governments: School System Finance F-33 File (F-33) and the National Center for Education Statistics' Longitudinal School District Fiscal-Nonfiscal File (FNF). The F-33 file contains quinquennial data spanning a 30 year period (1972-2002). The

[2] A non-trivial amount of money has been spent on public education following court-mandated school finance reform. Atkins (2007) estimated responses to court-mandated school finance reform total $34 billion annually, an average of $976 per-pupil in 2004 dollars.

3. As of December 2007, school funding cases have not been filed in Delaware, Hawaii, Mississippi, Nevada, and Utah.

FNF file contains data for each year over an 11 year period (1990-2000). From each data source, we draw expenditure figures for more than 16,000 public school districts.

Our results suggest that court-mandated equity reform decreases within-state resource inequities. Estimates are very similar to those reported in previous research examining the impact of court-mandated reform on resource distribution patterns (Murray, Evans, and Schwab, 1998; Corcoran et al, 2003). We also find that court-mandated adequacy reform decreases horizontal resource inequities when compared to states that have not had their funding mechanism ruled unconstitutional.

Our results are mixed on whether different resource distribution patterns exist following court-mandated equity versus adequacy reforms. Estimates based on the F-33 data file do not suggest statistically different resource distribution patterns following a state court declaring their school funding system unconstitutional on equity versus adequacy grounds. Estimates based on the FNF data file, on the other hand, offer evidence that equity and adequacy reforms are different, in that court-mandated adequacy reform does not decrease horizontal inequities as much as equity reform.

We also investigated whether the difference detected between court-mandated equity and adequacy reforms was associated with adequacy perpetuating the "right" kind of horizontal inequities. School finance theory suggests that resource distribution patterns connected to school finance adequacy should vary according to certain educational needs of students so that all students, regardless of educational need, have the opportunity to reach the state-standard level of proficiency. Consequently, if a state starts from a position of relatively equal per-pupil expenditure, an adequacy ruling could promote unintentionally an increase in horizontal inequities by elevating spending in the poorest districts above that elsewhere. Contrary to school

finance theory, however, we do not find that court-mandated adequacy reform resulted in increased school funding for students from disadvantaged backgrounds; nor do we detect any statistically meaningful associations between per-pupil expenditure and student need at the district level when state funding mechanism are declared unconstitutional on equity or adequacy grounds.

While we put forward findings from the first study of school finance reforms engendered by equity and adequacy rulings, it is important to acknowledge some limitations. First, our data are limited to spending figures at the district level and therefore cannot detect horizontal inequities across schools within a district. Second, our analyses focus on patterns of resource distribution as means to compare court-mandated equity and adequacy reforms. We do not compare other reform ingredients that differentiate school finance adequacy from equity, including instructional processes and student outcomes. Finance reform may also occur in the absence of court intervention.

The paper that follows is divided into 7 sections. In section 2, we review relevant literature on court-mandated school finance reform, outlining in section 3 data sources, data development procedures, and variable coding methods used in the study. Section 4 describes the three measures of horizontal equity used as dependent variables; section 5, the analytic strategies employed. Section 6 briefly describes general trends in United States public school spending. In section 7, we detail results from our empirical analyses of court-mandated school finance reform. Section 8 concludes our study of the impact of court-mandated reform on resource distribution.

Review of Relevant Literature

A review of relevant literature reveals that while there are a considerable number of studies that have investigated school finance equity and/or adequacy, relatively few studies have attempted to empirically investigate the impact of court-mandated school finance reform on a national scale. Furthermore, no study has investigated whether the reforms engendered by school finance equity and adequacy approaches are actually different in terms of resource distribution. This is due, in part, both to data limitations and to the fact that present school finance research has become increasingly focused on micro-level analyses of resource distribution patterns,[4] methods for operationalizing educational adequacy,[5] and whether a redistribution of resources impacts student outcomes.[6] Nevertheless, extant differences between equity and adequacy remain largely unexplored. Specifically, it is presently unknown whether greater spending on education attributed to court-mandated school finance reforms has benefited students requiring additional resources or found all districts in a state spending more.

In 1998, Murray, Evans, and Schwab conducted the first national evaluation on the impact of court-mandated school finance reform on resource allocation. They generated a nationwide panel dataset with more than 16,000 districts and estimated a series of econometric models to assess whether funding disparities had decreased within and between states from 1972

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4. Within-district studies were first explored by Summers and Wolfe (1978) and most recently by Stiefel, Berne, and Rubenstein (1998), Betts, Rueben, and Dannenberg (2000), Iatarola and Stiefel (2003), and Roza and Hill (2004). Some of these studies contrast horizontal and vertical equity principles. However, within-district analyses do not permit state-by-state renderings of resource allocation patterns. At the same time it is important to acknowledge that such studies are motivated by an equally, if not more, important question of how resources are distributed across schools.

5. See, for example, Taylor, Baker, and Vedlitz (2006), Duncombe and Lukemeyer (2002), Guthrie and Rothstein (1999). For a critique of these techniques, see Hanushek (2007, 2006, 2005), Springer and Guthrie (2007), and Guthrie and Springer (2007).

6. A growing body of literature examines if redistribution of resources impacts such education outcomes as SAT or ACT scores, standardized reading and math scores, drop out rates, and/or private school attendance patterns. See, for example, Roy (2004a; 2004b), Clark (2003), Card and Payne (2002), Hoxby (2001), and Husted and Kenny (2000).

to 1992. Murray and colleagues concluded that as a result of court-mandated reform intrastate inequity was dampened to the point that disparities between states were greater than disparities within states; spending rose in the lowest and median spending school districts and remained constant in the highest spending districts; and increased spending was a result of higher taxes and not a reallocation of resources from other government expenditure categories such as hospitals, health care, and highways. Corcoran et al (2003) extended these analyses to include data from the 1997 U.S. Census of Governments, reaching conclusions similar to those of Murray, Evans, and Schwab (1998).

Card and Payne (2002) studied the effect of school finance reforms on the distribution of school spending and student test scores. Using U.S. Census of Governments data from 1977 to 1992, Card and Payne found that states under court-mandated reform tended to adopt more equitable funding formulas, as detected by the relative amounts of state aid received by low and high income districts. Their estimates suggested that each additional dollar received by a school district in response to court-mandated reform led to anywhere between a 30 and 65 percent increase in spending. Card and Payne further found that states under court-ordered finance reform experienced a greater reduction in the test score gap between students in low and high income districts on the SAT than states with no court-mandated reform. This latter finding, however, is limited by the fact that only a select set of students in a particular state take the SAT, a standardized test for college admissions in the United States.

More recently, Baicker and Gordon (2006) investigated the broader effects of school finance reform on resources available to schools as well as other publicly-funded programs across all localities. Unlike research conducted by Murray, Evans, and Schwab (1998) and Card and Payne (2002), Baicker and Gordon employed the county area as the unit of observation. County areas are defined by the U.S. Census of Governments and represent a higher level of aggregation

(e.g., a county area may include multiple school districts). Their estimates of the impact of mandated school finance reform on the level and progressivity of state spending on education aligned with those of previously published studies. However, increased spending on education was systematically linked to marginal declines in spending on other state-funded programs. That is, even though court-mandated school finance reform increased funding available to county areas, these increases were attributed to a partial reallocation of resources previously apportioned for health and hospitals, highways, and public welfare programs.

Extant research provides considerable insight into the impact of school finance reform on resource distribution in American public education.[7] No research, however, has attempted to separate the impact of the two most prominent principles driving school finance reform for more than three decades – equity and adequacy. As such, this study endeavors to discern whether different resource distribution patterns emerge following court-mandated equity and adequacy reforms.

Data Sources, Data Development and Coding Procedures

This section reviews our data sources, data development, and coding procedures. We also discuss general trends of state court decisions that overturned school funding mechanisms by state from 1971 to 2005.

Data Sources

7. Our review focuses specifically on research that investigated the impact of court-mandated school finance reform on resource distribution using national level data. Other studies certainly have been influential in defining the field's broader understanding of school finance equalizations. However, these studies tend to look beyond the influence of court-mandated school finance reform on resource distribution and, as a result, are not included in our review. For example, Hoxby (2001) defines each state's school funding mechanism using regression-based techniques and then applies this taxonomy to demonstrate different school finance equalization schemes impact on the level of per-pupil spending, inequity in per-pupil spending, property values, private school attendance, and student achievement.

This study uses two data sources. The first set of data is drawn from the U.S. Census of Governments: School System Finance F-33 File. A census of governments has been taken in every year ending in either 2 or 7 since 1957, as required by Title 13, United States Code, Section 161. The census covers three main areas: government organization; public employment; and government finances. This study relies on the government finances F-33 file, which contains revenue, expenditure, debt, and asset information for public elementary and secondary education. Our analyses of the F-33 data file spans a 30 year period (1972-2002) and focuses on expenditure figures.

The second set of data is drawn from the Longitudinal School District Fiscal-Nonfiscal (FNF) File. The FNF file is collected by the National Center for Education Statistics of the United States Department of Education and the Governments Division of the United States Bureau of the Census. All data are generated from the annual Common Core of Data survey and Common Core of Data School District Finance survey. The FNF file contains fiscal information for the academic years 1989-1990 through 1999-2000 and nonfiscal information for academic years 1988-1989 through 2000-2001. Our analysis of the FNF file spans an 11 year period (1990-2000) and focuses on expenditure figures.

To evaluate the comparability of the two data files, we calculated the correlation between state-level per-pupil expenditure in 1992 and 1997 (r = .94 and .99, respectively) and the correlation for Theil Index, Coefficient of Variation, and natural logarithm of Federal Range Ratio in 1992 and 1997 (r = .89 or greater for each of the three comparisons in both years). We also calculated the correlation for the rate of change for the three inequity measures between 1992 and 1997. The degree of the relationship in the rate of change between the F-33 and FNF data files for the Coefficient of Variation and Theil Index were moderately strong (r = .83 and .82, respectively).

There was a moderate correlation for the log of the Federal Range Ratio (r = .42). All comparisons focused on 1992 and 1997 since these are the only two overlapping years.

Some scholars have criticized using the U.S. Census of Government F-33 file in school finance research, arguing that observations taken every fifth year are not refined enough to capture changes in school funding mechanisms (Reed, 1998). The FNF data file is arguably the more relevant and credible data source for analyzing resource distribution patterns following court-mandated school finance reform.

Data Development

In many respects data development procedures for both data sets are similar to those employed by Murray, Evans, and Schwab (1998) and Corcoran et al (2003). Four states (i.e., Alaska, Hawaii, Montana, and Vermont) and the District of Columbia were deleted from both data files. Alaska was removed because of its unique education governance structure and the fact that only a sample of districts had reported finance data in 1982.[8] The state provides much of the financial support of local education agencies, and in several regions no local governments are organized to collect taxes. In 1997, 19 of Alaska's 53 school districts were dependent upon state and federal support to operate their school systems. Furthermore, sizable variance in expenditure among Alaska's city and borough school districts makes comparison of inter-district inequities problematic.

Hawaii and the District of Columbia (DC) were deleted from both data files since their respective school systems are a single district. Hawaii is a state operated school system with only one district, and DC has only one school district within its jurisdiction. The governance

8. Hussar and Sonnenberg (2000) note that, "There were 33 districts on the F-33 for Alaska in 1982, which was a universe year. This was the same number reported in 1981, which was a sample year, and substantially less than in the two closest universe years of 1980 (52 districts) and 1987 (55 districts)" (A2.7).

structures in Hawaii and DC mean that all funds are allocated to one source. As such, it is not possible to examine disparities in expenditure over time and across multiple units in these two states.

Montana and Vermont were deleted because they are predominantly composed of independent school districts. In 1997, for example, Montana operated 447 school districts, of which all are independent. Vermont operated 292 school districts, of which all were independent. We did not reconcile spending differences across different types of school districts because more than 90 percent of all U.S. public school students are educated in unified school districts. Any school district with zero or missing enrollment and/or expenditure was also deleted from the final datasets upon which regression analyses were run.

An expenditure measure was used to calculate the three horizontal equity measures used as dependent variables. We selected an expenditure measure since reporting of expenditure measures is more consistent over time and across districts and states than revenue figures. States have been required to use accounting principles identified in the *Financial Accounting for Local and State School Systems* or the *Financial Accounting for Local and State School Systems 1990* for expenditure data and not revenue data. Discussion of the three measures of horizontal equity measures follows in the next section.

More specifically, this study relies on total current spending for elementary and secondary education programs. Current expenditure has two principal advantages when compared to instructional expenditure. First, current expenditure is one of the items used to calculate a state's per pupil expenditure, which is then used in the funding formula for allocating Title I funds. Current expenditure is therefore subject to audit by the Inspector General's Office of the United States Department of Education. Second, instructional expenditure, when used in

lieu of current expenditure, fail to capture higher and lower income districts' deferment of capital expenditure and maintenance to keep class sizes and teacher salaries at par with neighboring districts.

We converted total current expenditure to per-pupil terms by dividing the district total current expenditure by the total enrollment number in a district. All expenditure data were deflated to 2002 dollars using the U.S. Bureau of Labor Statistics' Consumer Price Index inflation calculator. Measures of horizontal equity can be sensitive to outliers and, as a consequence, outliers were removed according to the same algorithm identified in Murray, Evans, and Schwab (1998). In each state, districts with per-pupil expenditure greater than 150 percent of the 95th percentile unweighted per-pupil expenditure or less than 50 percent of the 5th percentile unweighted per-pupil expenditure were removed.[9]

Coding Procedures

Equity and adequacy are the two most prominent principles in school finance policy. Our research focuses on the impact of court-mandated school finance equity and adequacy reforms on resource distribution because the legal system has compelled school finance reform for more

9. Even though we removed outliers during data development, it remains feasible that outliers, leverage, and influence points will surface after modeling relationships between dependent and independent variables, thus prompting unwanted changes in regression coefficients and unwanted influence on standard errors. *RStudent*, hat-values, *DFFITS*, and *COVRATIO* values were calculated to identify if these points exist in our data; and, if so, to appraise how these points may affect model estimates. *RStudent* is the studentized residual. The studentized residual is a good index of the unusualness of y given the xs. Hat-value (h_I) measures the distance from the point of means of the xs, taking into account the correlation structure of the xs. *DFFITS* statistic is a scaled measure of the change in the predicted value for the ith observation and is calculated by deleting the ith observation. *COVRATIO* statistic measures the change in the determinant of the covariance matric of the estimates by deleting the ith observation to better understand influence of outlier values on standard errors which impact the precision of estimation. Results indicated no suspect values that warrant discussion. For a more complete explanation of these regression diagnostics see Fox (1997), Belsley (1980), and Chatterjee and Hadi (1988).

than three decades.[10] The number of these reforms has been widespread as illustrated in Table 1. Eleven states had their funding mechanism ruled unconstitutional on equity grounds on at least one occasion, while 20 states had their funding mechanism overturned on adequacy grounds on at least one occasion. Most equity decisions occurred prior to Kentucky's *Rose v. Council for Better Education* (1989), which is widely regarded as changing the guard to school finance adequacy from equity (see, for example, Guthrie, Springer, Rolle, and Houck, 2007; Ladd and Hansen, 1999). The exceptions are *Tennessee Small School Systems vs. McWherter* (1993) and *Edgewood Independent School District vs. Kirby* (1991; 1992; 1995, Texas).

Insert Table 1 Here

There is modest disagreement among studies about court rulings on constitutionality of state finance systems. Baicker and Gordon (2004) noted, for example, that Card and Payne (2002) list New Jersey rulings in 1989 and 1991, whereas Murray, Evans, and Schwab (1998) and Corcoran et al. (2003) only list a 1990 decision. Baicker and Gordon (2004) code Rhode Island's school funding mechanism being ruled unconstitutional in 1995, even though our review found evidence to the contrary.[11] We generated Table 1 using information from: National Access Network's state by state school finance litigation map; Murray, Evans, and Schwab (1998); and Minorini and Sugarman (1999). When we encountered discrepancies among these sources we checked filing dates catalogued in Westlaw, an online legal research service. We further validated our coding of court cases with a wealth of information recently published by West and Peterson (2007).

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10. Some research has made distinctions among school finance equalizations. See, for example, Aaronson (1999), Card and Payne (2002), Hoxby (2001), and Downes and Shah (2006).

11. Even though Superior Court Judge Needham declared the state's finance system unconstitutional in 1994, the Rhode Island Supreme Court reversed Judge Needham's decision in 1995. The Supreme Court not only determined the Constitution did not require an "equal, adequate, and meaningful" education, but also noted the General Assembly maintained authority over the education system.

Information contained in Table 1 was used to create a series of indicator variables. The first, *overturned*, is a dichotomous variable set to one in the year and all subsequent years that a state's finance system was overturned on equity or adequacy grounds. *Overturned* was set to zero in all years prior to a state's school funding mechanism being declared unconstitutional or if a state's funding was never ruled unconstitutional. We use the *overturned* variable to model the impact of all court-mandated reform on measures of horizontal equity.

Overturnedadequacy is a dichotomous variable set to one in the year, and all subsequent years, in which a state's finance system was overturned on adequacy grounds. *Overtunedadequacy* is set to zero in all years prior to a school funding mechanism being overturned, or if a state's finance system was never ruled unconstitutional. We use the *overturnedadequacy* indicator to model the impact of court-mandated adequacy reform on resource distribution. We also use it in conjunction with *overturned* in select specifications as a differences-in-differences estimate of the average court-mandated school finance reform treatment effect.

Funding mechanisms in five states have been overturned on equity grounds and subsequently on adequacy grounds. We created a third indicator, *overturnedequity*, to separate differences between the states overturned on both principles versus states overturned on a single ruling. *Overturnedequity* is set to one in the year, and in all subsequent years, in which a state's finance system was ruled unconstitutional on equity grounds. *Overturnedequity* was set to zero in all years prior to the state funding mechanism being declared unconstitutional, or if a state's funding mechanism was never overturned.

Measures of Horizontal Equity

Horizontal equity is used as our theoretical base for equity measurement. We assume horizontal equity is improved within a particular state if the degree of inequality in the average inter-district per-pupil expenditure is decreased. This assumption is made necessary by the absence of information on individual students' situations. We weighted per-pupil expenditure figures by yearly student enrollment in each district to control for skewness in student population across districts. Rather than relying on a single measure of horizontal equity, we calculated the Theil Index, coefficient of variation, and natural logarithm of the Federal Range Ratio. Each of these dependent variables is briefly described below.[12]

Theil Index

The Theil Index was developed by Henri Theil in 1975 as a measure of information exchange and then later identified by education finance scholars as an adequate measure of dispersion for horizontal equity. Unlike other measures of horizontal equity, the distribution of the Theil index is approximately normal. It can be expressed as follows for state *k*:

$$Theil = \frac{\sum_{j=1}^{Jk} P_{jk} X_{jk} \ln\left(\frac{X_{jk}}{\overline{X}_k}\right)}{\sum_{j=1}^{J_k} P_{jk} X_{jk}}$$

where, P_{jk} is the total student enrollment in district *j* in state *k*, X_{jk} is per-pupil expenditure in district *j* in state *k*, and $\overline{X}_k$ is the weighted mean per-pupil expenditure for all pupils in each state. Equality in per-pupil expenditure is reached when the value of the Theil Index is equal to zero.

Coefficient of Variation

12. See Berne and Steifel (1983) for more information on measures of equity.

The coefficient of variation is the standard deviation divided by the mean. It measures how tightly the per-pupil expenditure in all the states' school districts cluster about the mean statewide expenditure. The coefficient of variation is inversely related to equity. If all schools spent exactly the same amount per student, the coefficient of variation would be zero. The coefficient of variation can be expressed as:

$$CofV = \frac{\sum_{k=1}^{K}\sum_{j=1}^{J_k} P_{jk}(X_{jk} - \overline{X})^2}{\sum_{k=1}^{K}\sum_{j=1}^{J_k} P_{jk}}$$

where, P_{jk} is the total student enrollment in district *j* in state *k*, X_{jk} is per-pupil expenditure in district *j* in state *k*, and $\overline{X}_k$ is the weighted mean per-pupil expenditure for all pupils in each state. It is important to note the coefficient of variation is very sensitive to extreme values, highlighting of the necessity in removing outlier values.

Natural Logarithm of the Federal Range Ratio

The Federal Range Ratio drops districts with per-pupil expenditure in both the top and bottom 5th percentiles. The 95th percentile per-pupil expenditure then is divided by the 5th percentile per-pupil expenditure. The natural logarithm of the 95th percentile over the 5th percentile ratio indicates how much larger the 95th percentile expenditure is than the 5th percentile expenditure.

Analytic Strategy

This study estimates the impact of court-mandated school finance reform on resource distribution, and investigates whether the average impact of court-mandated equity and adequacy

reforms result in different resource distribution patterns. Our basic analytic framework relies on two sets of equations: a state and year fixed effects model and a two-stage regression model.

State and Year Fixed Effects Model

The first set of analyses relied on a state and year fixed effects model to measure how inequity changes within a state as the legal environment changes. A fixed effects estimator was selected to control for unobserved time invariant characteristics of the state that could be correlated with the state's measured level of inequity. Even with omission of relevant time invariant effects in equation (1), a fixed effects estimator is robust to specification errors that typically would confound how horizontal equity changes within a state in response to state supreme court ruling. A state fixed effects estimator again is the preferred estimator given that most of the sample variation in inequality is between, as opposed to within, states.

The first model reported can be expressed as:

$$Y_{it} = \alpha_0 + \alpha_1 overturned_{it} + \mu_i + \eta_t + \varepsilon_{it} \qquad (1)$$

where, Y_{it} is one of the three within-state measures of horizontal equity, α_0 is the average difference in horizontal equity between states overturned and not overturned by school finance litigation, $overturned_{it}$ is the status of litigation in state i at time t, μ_i is the state fixed effect, η_t is the year fixed effect, and ϵ_{it} is a random error term. It is hypothesized that court-mandated school finance reform decreases horizontal inequity. A statistically significant, negative coefficient on *overturned* would indicate that court-mandated reform reduced the average level of disparity in per-pupil spending within the state. The magnitude of the average effect of court-mandated reform on within-state measures of horizontal equity are likely to be smaller when compared to similar estimates reported in previous work because adequacy, as defined in theoretical scholarship, promotes vertical equity.

The second model reported can be expressed as:

$$Y_{it} = \alpha_0 + \alpha_1 overturned_{it} + \alpha_2 overturned\ adequacy_{it} + \mu_i + \eta_t + \varepsilon_{it} \quad (2a)$$

where, Y_{it} is one of the three within-state measures of horizontal equity, α_0 is the average difference in horizontal equity between states overturned by equity cases and state funding mechanisms never overturned, α_2 is the average difference in horizontal equity between state funding mechanisms overturned on equity grounds and state funding mechanisms overturned on adequacy grounds in state *i* at time *t*, μ_i is the state fixed effect, η_t is the year fixed effect, and ϵ_{it} is a random error term. We are most interested in the estimate on: $\alpha_0 + \alpha_1 + \alpha_2$ which indicates the average index for state funding mechanisms overturned by an adequacy ruling; and the value on α_0 which differentiates the average impact of court-mandated equity and adequacy reforms on resource distribution.

An alternative specification of (2a) can be expressed as:

$$Y_{it} = \alpha_0^{'} + \alpha_1^{'} overturned_{it} + \alpha_2^{'} overturned\ equity_{it} + \alpha_3^{'} overturned\ adequacy_{it} + \mu_i + \eta_t + \varepsilon_{it} \quad (2b)$$

where, Y_{it} is one of the three within-state measures of horizontal equity, $\alpha_2^{'}$ is the average difference in horizontal equity between state funding mechanisms overturned on both equity and adequacy and states overturned by only an adequacy ruling, and $\alpha_3^{'}$ is the average difference in horizontal equity between state funding mechanism overturned by both equity and adequacy and state funding mechanism overturned by only an equity ruling, μ_i is the state fixed effect, η_t is the year fixed effect, and ϵ_{it} is a random error term. This alternative specification also enables us to understand: the average index for states that have never been overturned (α_0); the average index for state funding mechanism overturned by an equity ruling ($\alpha_0 + \alpha_1 + \alpha_2$); the average index for

state funding mechanism overturned by an adequacy ruling ($\alpha_0 + \alpha_1 + \alpha_3$); the average index for state funding mechanism overturned on both equity and adequacy ($\alpha_0 + \alpha_1 + \alpha_2 + \alpha_3$); and the average difference between state funding mechanism overturned by only adequacy and state funding mechanism overturned by only equity ($\alpha_3 - \alpha_2$). More specifically, this alternative specification reveals whether there are systematic differences among states that had their funding mechanism overturned on both principles and those states that had their school funding mechanism overturned on one principle alone.

Models (1), (2a), and (2b) cannot fully explain potentially significant differences between court-mandated equity and adequacy reforms. Although adequacy cases do not aim at equalizing per-pupil expenditure, an adequacy ruling essentially will have the same effect as an equity ruling if low socioeconomic students predominantly attend schools with below-average per-pupil expenditure;[13] that is, a transition to a system that guarantees an adequate education to everyone will require spending more on low socioeconomic students. If this is the case, there will not be much difference in the detected response to an adequacy or equity ruling overturning a state's funding mechanism. We therefore look to another analytic strategy to measure resource distribution patterns following court-mandated school finance eform.

Two-Stage Regression Model

Our second analytic strategy, a two-stage regression model, compensates for shortcomings of equations (1), (2a), and (2b) that might mask the true average effect of court-mandated adequacy reform on resource distribution. School finance adequacy reform may perpetuate the "right" kind of horizontal inequity, i.e. resource inequity resulting from a state

13. There are a number of reports documenting low socioeconomic students predominantly attend schools with below-average per-pupil expenditures. See, for example, The Education Trust's annual reports on the distribution of state and local funding.

funding mechanism taking into account varying needs of different types of students. Our two-stage regression model first calculates the average correlation between the percentage of students eligible for free and reduced price lunch and per-pupil expenditure in a state to create a proxy for students requiring additional resources. We then estimate a second regression equation in which the index for students requiring additional resources from the first-stage are a function of legal environment changes within a state. Although our two-stage regression model could be run as a single procedure, using two-stages offers several important benefits. Most notably, we can illustrate diversity in student need at the district level and this diversity's relation to per-pupil expenditure through the two-stage procedure's reduction in observations. All second-stage models are estimated by weighted least squares, using as weights the inverse sampling variance of the estimated correlation between per pupil expenditure and district income.

The unrestricted model can be expressed as:

$$PPE_{kit} = \beta_0 + \beta_{1,it} PCTFRL_{kit} + \beta_{2,it} \mathrm{X}_{kit} + \mu_i + \eta_t + \varepsilon_{kit} \qquad (3)$$

$$\beta_{1,it} = \pi_0 + \pi_1^{'} overturned_{it} + \pi_2 overturnedadequacy_{it} + \mu_i + \eta_t + \varepsilon_{it}$$

where in the first stage, PPE_{kit} is current per-pupil expenditure in district *k* in state *i* at time *t*, β_0 is the intercept, $PCTFRL_{kit}$ is percentage of student population eligible for free and reduced price lunch program in district *k* in state *i* at time *t*, which serves as the primary index of students requiring additional resources, and X_{kit} is a vector of district level demographic factors, including percentage of minority students, percentage of students in a special education program, which are used as additional controls for student needs. State fixed effect u_i and year fixed effect n_t are also controlled in the model. In the second stage, $overturned_{\mathrm{it}}$ is the status of all

litigation in state *i* at time *t*, $overturnedadequacy_{it}$ is the status of adequacy litigation in state *i* at time *t*, μ_i is the state fixed effect, and ϵ_{kit} is a random error term.

The first stage was run eleven times, once for each year in the FNF data file. The β_1 coefficient describes the average correlation between district level percentage of free-reduced price lunch eligible students and per-pupil expenditure. We are not interested in the causal relationship between low socio-economic status and per-pupil expenditure. Rather, *PCTFRL* is used as a proxy for students requiring additional resources, and β_1 is used as the dependent variable in the second stage to distinguish the difference in the pattern in each state for each year. The second stage has 516 observations (46 states, 11 years).

Table 2 further demonstrates how estimates on β_1 in the first stage of equation (3) are used as a dependent variable in the second stage regression model. We selected: Massachusetts because their school funding mechanism was overturned on adequacy grounds in 1993; and Pennsylvania because their school funding mechanism was not ruled unconstitutional by the Supreme Court of Pennsylvania during the period under study (1972-2002). It is evident the school funding mechanism in Massachusetts became more equitable in the years following the *McDuffy v. Secretary of Executive Office of Education* (1993) school finance adequacy decision, and that significantly more dollars were allocated to high need districts overtime (e.g., the value on the β_1 coefficient is positive and statistically different from zero from the 1995-1996 to 1999-2000 school years). Although the relationship between spending and student need decreased monotonically in Pennsylvania during the same time period, the decrease in within-state inequity never reached the magnitude revealed by Massachusetts' funding mechanism; nor did Pennsylvania's state funding mechanism result in more dollars going to high need districts, what is known as vertical equity.

Insert Table 2 Here

Generally speaking, our second stage model estimates the average impact of court-mandated reform based on equity or adequacy grounds, and if resource allocation patterns resulting from adequacy reform are different from equity reform. A statistically significant, positive coefficient on *overturnedadequacy* would indicate that on average more money per-pupil is allocated to low income districts when a state's funding mechanism is constitutionally inadequate than when a state's funding mechanism is overturned on equity grounds. We anticipate a statistically significant, positive value on *overturnedadequacy*. This hypothesis is supported by a wealth of theoretical scholarship indicating that school finance adequacy accounts for varying needs of different types of students (e.g., vertical equity), while school finance equity promotes fairness in the distribution of educational goods and services (e.g., horizontal equity).

This study also explored the possibility that our panel data is nonstationary, thus giving the appearance that independent variables are more significant than they should be. Bertrand, Duflo, and Mullainathan (2004) explicate the importance of accounting for autocorrelation in differences-in-differences estimation, finding that conventional standard errors may grossly understate the standard deviation of the estimated treatment effect. It is suggested state-clustered standard errors corrects for autocorrelation, a technique employed in Hoxby (2001). Berry (2007) further demonstrates the differential impact of state-clustered standard errors versus robust standard errors when estimating the impact of school finance equalization, especially when the outcome measure is revenue or expenditure figures. As a consequence, we estimated all of our models using both robust standard errors and state-clustered standard errors to account for possible autocorrelation in the residual and heteroskedasticity. Results are qualitatively

similar whether using robust or state-clustered standard errors, a result attributed to use of an index measures as the outcome of interest.

General Trends in United States K-12 Public School Spending

Public education in the United States is primarily the responsibility of local and state governments as a consequence of the United States constitution defaulting plenary authority to state and local control. Local funding sources made up over 80 percent of all public school revenues well into the 1930s, after which redistribution of resources increasingly occurred as states formalized mechanisms for distributing revenue to communities (e.g., foundation aid programs or percentage equalizing plan). It was also during this time that states began implementing policies intended to promote the provision and expansion of public schooling.

Table 3 displays more recent trends in the percent distribution of revenue by governmental source, a period in which state governments assumed increased monetary responsibility in support of public education. During this time, local revenue as a percentage of total revenue decreased by almost 25 percent. Furthermore, dispersion in revenue shares from local and state sources was reduced by one-third. Today, local and state sources provide near equal shares of school revenue while also accounting for more than 90 percent of all public school expenditure.

Insert Table 3 Here

Table 3 and Table 4 report national trends in resource distribution for the three measures of horizontal equity used as dependent variables in this study. Average levels of horizontal equity remained relatively constant from 1972 to 1987, at which time there was a precipitous

drop in the 1990s (Table 3). Table 4 provides a more refined look at this drop in national inequity in resource distribution from 1990 – 2000.

Insert Table 4 Here

Results

This section presents and discusses estimation results from several specifications based on equations (1), (2a), (2b), and (3). Specifically, we address the average impact of court-mandated school finance reform on resource distribution, and whether different resource distribution patterns emerge following court-mandated equity and adequacy reforms.

What is the impact of court-mandated reform on resource distribution?

Table 5 displays results from a series of model specifications that include state and year fixed effects to control for time invariant characteristics of a state that could be correlated with a state's measured level of horizontal equity. Panel A reports estimates using data from the F-33 file and Panel B reports estimates using data from the FNF file. Dependent variables are the three measures of horizontal equity discussed earlier. In all specifications, we are interested in how the measures of horizontal equity change within a state as the legal environment changes.

Insert Table 5 Here

Models 1.1 and 1.3 indicate court-mandated school finance reform is a statistically significant predictor of decreased levels of horizontal inequities, a finding that holds true for all three measures of horizontal equity and when estimates were generated using data from both the F33 and FNF files. Furthermore, the magnitude and direction of estimates on *overturned* are remarkably similar to the average impact of court-mandated reform on resource distribution reported in Murray, Evans, and Schwab (1998) and Corcoran et al (2003).

School finance reform may be implemented over several years following a state court declaring a state's funding mechanism unconstitutional. Reform is subject to systemic changes in state and local policy, both of which often are subject to legislative approval. Models 1.1 and 1.3 may understate the average impact of court-mandated reform on resource distribution if state court decisions manifest several years after a legal ruling. To examine the potential lagged effect of school finance reform, we estimated a second series of models that included a variable labeled *years after overturned*. *Years after overturned* is a continuous variable equal to the number of years since a state court overturned a state's funding mechanism. *Year after overturned* is set to zero if a state court never declared its state funding mechanism unconstitutional, or if a legal ruling was never made on a state's funding mechanism.

Models 1.2 and 1.4 indicate the average decrease in the level of horizontal equity following a court declaring a state's funding mechanism unconstitutional when the *years after overturned* variable is included in the regressions. The value on the *years after overturned* coefficient was not statistically different from zero when estimates were based on data from the F-33 file. The estimate on *years after overturned* was marginally significant when the dependent variable was the natural logarithm of the Federal Range Ratio and analyses were based on data from the FNF file. However, other analyses conducted as part of our analytic strategy did not detect a lagged effect. Hence, we do not report the *years after overturned* variable in future model specifications since it appears the decrease in resource inequality can be attributed to the court decision.

Do different resource distribution patterns exist following court-mandated equity and adequacy reforms?

Table 6 displays results from a difference-in-differences style general linear model with state and year fixed effects. Panel A reports results based on data from the F-33 file and Panel B reports results based on data from the FNF file. Dependent variables are the three aforementioned measures of horizontal equity. Models 2.1 – 2.8 examine how horizontal equity changes within a state as the legal environment changes. Moreover, we investigate if there are statistically meaningful differences in the average policy effect of court-mandated equity versus adequacy reforms on resource distribution.

Insert Table 6 Here

Our most striking finding is evident when comparing results from models 2.3 and 2.7. Model 2.3 indicates that within-state inequities decreased following court-mandated equity reform. The estimate on *overturnedadequacy* suggests that court-mandated adequacy reform is not statistically different from the average impact of court-mandated equity reform on resource distribution. Generally speaking, we detected negligible difference between court-mandated equity and adequacy reforms when measures of horizontal equity are the dependent variable.

A different story emerges when the same set of specifications are estimated using data from the FNF file (see Model 2.7). The sign on our difference-in-differences estimators (identified by *overturnedadequacy*) are positive, and the magnitude of the values of these coefficients are statistically different from zero. Our estimates indicate a positive, statistically significant difference in the average policy effect of court-mandated equity and adequacy reforms on resource distribution. Specifically, Model 2.7 approximates that: (1) adequacy reform is statistically different from equity reform; (2) adequacy reduced inequity when compared to no court-mandated reform; and (3) adequacy decreases inequity to a lesser extent than equity reform.

Estimates from Models 2.3 and 2.7 may not be strictly correct because the reality of school finance litigation includes a handful of instances in which state funding mechanisms have been ruled unconstitutional on equity grounds and then later ruled unconstitutional on adequacy grounds. There are no instances of a formal court-mandated adequacy reform predating an equity ruling; the concept of school finance adequacy was born of the equity movement (Ladd and Hansen, 1999). Estimates on *overturnedequity* may be biased downward if a state has a relatively equitable process for distributing resources, as most likely would be the case for states that had their funding mechanism previously overturned on equity grounds, since adequacy rulings could promote resource inequities by allocating more resources to the highest need districts.

Models 2.4 and 2.8 explore whether there are systematic differences among the four states that had their school funding mechanism overturned on both principles and those states that had their school funding mechanism overturned on one principle alone. We find that estimates on *overturned* are no longer statistically significant when using data from the F-33 file. The magnitude of the values on the *overturned* and *overturnedadequacy* coefficients decreases in size considerably when compared to that of estimates in Model 2.3. The signs on the coefficients remain consistent from Model 2.3 to Model 2.4.

There are large standard errors associated with the estimated coefficients reported in Model 2.4. A loss in the accuracy of predictions may be associated with aggregation of the unit of observation to the state level and with the small number of observations in each cell. Furthermore, as noted by Reed (1998), observations taken every fifth year at the state level may not be refined enough to capture more nuanced changes in school finance systems. Reed's observation is particularly meaningful in light of the fact that estimates from the same set of

alternative specifications using data from the FNF file (Model 2.8) are nearly identical to those reported in Model 2.7. It appears our earlier estimates may not be biased by the fact that school funding mechanisms in some states have been overturned on both equity and adequacy grounds.

Does adequacy-based reform further reduce inequity or perpetuate the "right" kind of inequity?

Table 7 presents results from a series of restricted two-stage regression models. These two-stage specifications are used to examine whether adequacy rulings result in higher average per-pupil expenditure in districts serving low socioeconomic students when compared to districts serving more economically advantaged students. The interesting question here is not horizontal equity per se, but rather whether the "right" kind of inequities results from court-mandated adequacy reform. This question is particular relevant given that the estimates generated from equation (2) indicate court-mandated adequacy reform reduced horizontal inequity, but did not reduce horizontal inequities to the same extent following court-mandated equity reform.

Insert Table 7 Here

Model 3.1 approximates the average impact of all court-mandated reform on the average association between per-pupil spending and student need. Estimates on *overturned* are not statistically significant at conventional levels. This finding is not unexpected given theoretical differences between the equity and adequacy approaches with regard to resource distribution. School finance equity is akin to horizontal equity, which proposes that similarly-situated students be treated similarly in terms of resource distribution. In contrast, school finance adequacy is akin to vertical equity, which suggests students who bring certain educational needs to the classroom require additional, non-traditional resources. As such, it is not out of the question that

estimates on the association between per-pupil spending and student needs are nullified via competing resource allocation practices.

Estimates reported in Models 3.2 and 3.3 approximate the average impact of court-mandated equity and adequacy reforms, respectively. Direction of the signs on the coefficients support our conjecture that the estimates reported in Model 3.1 may have been cancelled due to competing resource distribution practices. Nonetheless, the estimates on both equity and adequacy reforms are not statistically different from zero.

Model 3.4 estimates whether there are differences between equity and adequacy reforms when the dependent variable is the association between per-pupil expenditure and district income. Estimates on *overturned* and *overturnedadequacy* are not statistically significant. Furthermore, we do not detect significant effects when separating states that had their school funding mechanism overturned on both principles (equity and then adequacy) from those that had their school funding mechanism overturned on a single ruling (see Model 3.5).[14]

Conclusion

The purpose of this study was to examine the impact of court-mandated school finance reform on resource distribution, and whether resource allocation practices differ following equity and adequacy rulings that overturn a state's school funding mechanism. This study focused on

14. Results reported in Table 6 and 7 are robust to controlling for: (1) within state, between district standard deviations in percentage of minority students, percentage of special education students, percentage of free and reduced price lunch eligible students, and district size; (2) state level indices of percentage of minority students, percentage of special education students, percentage of free and reduced price lunch eligible students, and district size; or (3) both within state, between district variances in student need and state level indices of student need. We included these controls in the event the level of inequity in a state is correlated with time variant population demographics. Furthermore, controls act as a proxy for variation in the determinants of the demand for education resources across districts in each state which may influence the inequity of education spending and/or education resource distribution within a state. These results are available from the corresponding author upon request.

court-mandated reform because state courts have played the principle role in school finance reform efforts for more than three decades. Although research clearly documents that court-mandated school finance reform has led to greater spending on education, it is unclear if greater spending benefited students requiring additional resources or found all districts in a state spending more.

We find that court-mandated equity reform decreased horizontal inequities, a finding supported when estimates are generated using data from either the F-33 file or FNF file. Our results also indicate court-mandated adequacy reform decreased horizontal inequities when compared to no court-mandated reform. Generally speaking, states that had a school funding mechanism declared unconstitutional by a state court have more equitable resource distribution practices than states that have not had their school funding mechanism ruled unconstitutional.

We found mixed results on whether there are different resource distribution patterns following court-mandated equity and adequacy reforms. Estimates using data from the F-33 file do not suggest statistically different resource distribution practices between equity and adequacy reforms. When we estimated the same model specifications but used data from the FNF file results indicated that equity and adequacy reforms are different, in that court-mandated adequacy reform does not decrease horizontal inequities as much as equity reform.

We hypothesized that resource distribution patterns associated with adequacy reform may take into account varying student needs by allocating additional resources to high need districts. This hypothesis is supported by a large body of theoretical literature on school finance adequacy. Surprisingly, our estimates were not statistically significant, suggesting, contrary to the expectations of some theorists, that resource distribution patterns are not significantly different following court-mandated equity and adequacy reforms.

It is important to acknowledge there are other reform ingredients that may differentiate school finance equity and adequacy reforms, but that these ingredients are not investigated in the current study. School finance adequacy places considerable emphasis on school outcomes whereas equity has a singular focus on resource inputs. Investigating whether outcomes vary following court-mandated equity and adequacy reforms is a practical direction for future research. Even so, our study clearly indicates that the additional dollars spent on American K-12 public schooling as a result of court-mandated school finance reforms have not necessarily resulted in states distributing resources differently to different districts, despite the two dominant reform principles in school finance-related policy – equity and adequacy – espousing very different notions of resource allocation.

References

Aaronson, D. (1999). The effect of school finance reform on population heterogeneity. *National Tax Journal*, 52, 5 – 29.

Atkins, C. (2007). Appropriation by Litigation: Estimating the Cost of Judicial Mandates for State and Local Education Spending. *State Tax Notes*, 45(13).

Baicker, K. and Gordon, N. (2006). The Effect of Mandated State Education Spending on Total Local Resources. *Journal of Public Economics*, 83, 49-82.

Belsley, D., Kuh, H., and Welch, R. (1980). Regression Diagnostics: Indentifying Influential Data and Source of Collinearity. New York, NY: Wiley Press.

Berne, R. and Stiefel, L. (1983). The measurement of equity in school finance: Conceptual, methodological, and empirical dimensions. Baltimore, MD: Johns Hopkins University Press.

Bertrand, M., Duflo, E., and Mullainathan, S. (2004). How much should we trust differences-in-differences estimates? *Quarterly Journal of Economics*, 119(1), 249-275.

Berry, C. (2007). The Impact of School Finance Judgements on State Fiscal Policy. In M. West and P. Peterson (2007). School Money Trials: The Legal Pursuit of Education Adequacy, 213 – 240. Washington, DC: Brookings Institution Press.

Card, D. and Payne, A.A. (2002). School finance reform, the distribution of school spending, and the distribution of student test scores. *Journal of Public Economics*, 83, 49-82.

Chatterjee, S. and Hadi, A.S. (1988). Sensitivity in linear regression. New York, NY: Wiley Press.

Clark, M.A. (2003). Education reform, redistribution, and student achievement: Evidence from the Kentucky Education Reform Act. Princeton, New Jersey: Mathematica Policy Research, Inc.

Clune, W.H. 1994. The shift from equity to adequacy in school finance. *Educational Policy*, 8(4), 376-394.

Corcoran, S. Evans, W.N., Godwin, J., Murray, S.E., and Schwab, R.M. (2003). The changing distribution of education finance: 1972 – 1997, In K.M. Neckermen (Ed.). Social Inequity. New York, NY: Russell Sage Foundation.

Fox, J. (1997). Applied Regression Analysis, Linear Models, and Related Methods. Sage Publications.

Guthrie, J.W., Springer, M.G., Rolle, A.R., and Houck, E.A. (2007). Modern education finance and policy. Boston, MA: Allyn and Bacon Press.

Guthrie, J.W. and Springer, M.G. (2007). Alchemy: Adequacy advocates turn guestimates into gold. Education Next, 7(1), 20-27.

Hanushek, E. A. (1998). Measuring Investment in Education. *Journal of Economic Perspectives*, 10(4), 9 – 30.

Hoxby, C.M. (2001). All school finance equalizations are not created equal. *The Quarterly Journal of Economics*, 116(4), 1189-1231.

Ladd, H.F. and Hansen, J.S. (1999). Making money matter: Financing America's schools. Washington, DC: National Academy Press.
Lake View School District No. 25 v. Huckabee (2001). 349 Ark. 481, 484, 10 S.W.3d 892.

Murray, S.E., Evans, W.N., Schwab, R.M. (1998). Education-Finance Reform and the Distribution of Education Resources. *The American Economic Review*, 88(4), 789-812.

Reed, D.S. (1998). Twenty-five years after Rodriguez: School finance litigation and the impact of the new judicial federalism. *Law and School Review*, 32(1), 175-220.

Rose v. Council for Better Education, 790 S.W. 2d 186 (KY Supreme Court, 1989).

Roy, Joydeep (2004a). The impact of school finance reform on resource equalization and academic performance: Evidence from Michigan. Department of Economics, Princeton University: Working Paper #8.

Roy, Joydeep (2004b). The impact of school finance reform on housing stock and residential segregation: Evidence from Proposal A in Michigan. Department of Economics, Princeton University: Working Paper.

Roza, M. and Hill, P.T. (2004). How within-district spending inequities help some schools fail. In D. Ravitch (Ed.), Brookings Papers on Education Policy: 2004. Washington, DC: The Brookings Institution, 201-227.

Serrano v. Priest, 487 P.2d 1241 (1971).

Springer, M.G., Houck, E.A., and Guthrie, J.W. (2007). History and Scholarship Regarding United States Education Finance and Policy. In H. Ladd and T. Fiske (Eds.). Handbook of Research in Education Finance and Policy, 3 – 23. Erlbaum.

Stiefel, L. Berne, R., and Rubenstein, R. (1998). Intradistrict equity in four large citities: Methods, data, and results. *Journal of Education Finance*, 23(4), 447-467.

Summers, A.A. and Wolfe, B.L. (1978). Intra-district distribution of school inputs to the disadvantages: Evidence for the courts. *Journal of Human Resources*, 11(3), 328-342.

West, M. and Peterson, P.E. (2006). School Money Trials: The Legal Pursuit of Education Adequacy. Washington, DC: Brookings Institution Press.

Table 1
Summary of State Court Rulings Overturning School Finance Systems, 1971 - 2005

State	Equity	Adequacy
Alabama		1993
Arizona		1994; 1997; 1998
Arkansas	1983	2002; 2005
California	1976	
Connecticut	1977	1996
Idaho		1998
Kansas		2005
Kentucky		1989
Massachusetts		1993
Michigan		1997
Missouri		1993
Montana	1989	2005
New Hampshire		1993; 1997;1999; 2002
New Jersey	1973; 1976	1990; 1994; 1997; 1998; 2000; 2002
New York		2003
North Carolina		2004
Ohio		1997; 2000; 2002
South Carolina		2005
Tennessee	1993	1995; 2002
Texas	1989; 1991; 1992; 1995	
Vermont		1997
Washington	1978	
West Virginia	1984	
Wisconsin	1976	
Wyoming	1980	1995; 2001

Source: West and Peterson (2007); ACCESS (2006); Murray, Evans, and Schwab (1998); Minorini and Sugarman (1999).

Table 2
First-Stage Estimates, Association Between Total Current Expenditure and Students Requiring Additional Resources, 1990 - 2000

	Massachusetts Overturned (1993)		Pennsylvania Not Overturned	
Year	β_1	p	β_1	p
1990	-22.94	0.008	-35.71	<.001
1991	-18.90	0.035	-39.24	<.001
1992	-17.08	0.047	-30.90	<.001
1993	-26.63	0.002	-34.41	<.001
1994	0.81	0.925	-32.59	<.001
1995	11.63	0.153	-27.58	<.001
1996	17.37	0.032	-24.91	<.001
1997	22.13	0.000	-10.65	0.014
1998	31.28	<.001	-8.69	0.064
1999	33.16	<.001	-12.35	0.004
2000	40.46	<.001	-9.52	0.023

Source: United States Census of Governments F-33 Data File

Table 3
Summary of Percent Distribution of Revenue and Total Per Pupil Expenditure by Source and Measures of Inequality

	1972	1977	1982	1987	1992	1997	2002
Percent Distribution of Revenue*							
Local							
Mean	53.7	49.7	47.3	45	45.4	44	41.1
Maximum	89.9	86.7	88.9	90.5	87.9	86.8	62.42
Minimum	23.8	19.3	18.3	12.6	13.2	14.6	13.84
Standard Deviation	16.4	14.8	16	15.4	14.9	14	11
State							
Mean	43.9	41.1	45.4	48.5	48.2	48.7	50.25
Maximum	70.9	63.7	73.7	74.5	74.7	72.2	71.95
Minimum	9	8.1	7.7	6.4	8.5	9.3	31.51
Standard Deviation	15.8	12.4	14.4	14	13.6	12.7	10.01
Federal							
Mean	2.5	9.2	7.3	6.5	7	7.4	8.65
Maximum	9	18.5	16.7	15.8	16.4	14.1	16.8
Minimum	0	4.1	2.9	2.7	3.6	3.6	4.2
Standard Deviation	1.9	4.1	3.1	2.6	2.6	2.6	2.9
Per Pupil Expenditure ($2002)**							
Local	2365	2439	2347	2810	3411	3444	3742
State	1715	2195	2482	3181	3367	3641	4310
Federal	399	447	386	410	479	501	691
Total	4479	5081	5215***	6400***	7257	7585	8742
Measures of Inequality							
Log of Federal Range Ratio	0.456	0.463	0.461	0.430	0.429	0.367	0.382
Coefficient of Variation	14.910	15.391	15.380	14.658	14.539	12.603	13.028
Thiel Index	0.011	0.012	0.012	0.011	0.011	0.008	0.009

* Excludes Hawaii and District of Columbia.

** Expenditure per pupil in fall enrollment from Digest of Education Statistics, Table 166.

*** Estimated figures due to changes in data collection procedures that began in 1980-1981 school year. Estimates produced by National Center for Education Statistics.

All expenditure figures in constant dollars ($2002)

Source: United States Census of Governments F-33 Data File

Table 4
Summary of Total Per Pupil Expenditure by Source and Measures of Inequality

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Per Pupil Expenditure ($2002)*											
Federal	347	358	392	394	406	404	398	405	436	462	495
State	2899	3024	3060	3310	3290	3510	3595	3693	3824	3987	4134
Local	3205	3226	3228	3286	3339	3257	3222	3260	3334	3408	3421
Total	6451	6608	6680	6990	7034	7171	7216	7358	7595	7857	8049
Measures of Inequality											
Natural Log of Federal Range Ratio	0.428	0.430	0.428	0.413	0.399	0.379	0.374	0.368	0.366	0.361	0.356
Coefficient of Variation	14.330	14.496	14.065	13.781	13.474	12.973	12.781	12.496	12.351	12.226	12.366
Thiel Index	0.011	0.011	0.010	0.010	0.009	0.009	0.008	0.008	0.008	0.008	0.008

* Expenditure per pupil in fall enrollment
All expenditure figures in constant dollars ($2002)
Source: National Center for Education Statististics FNF Data File

Table 5
Fixed Effects Estimates, Inequality in Total Current Expenditure Models

	Panel A, 1972 - 2002		Panel B, 1990 - 2000	
	Dependent Variable: Natural Log of Federal Range Ratio		*Dependent Variable: Natural Log of Federal Range Ratio*	
	1.1	1.2	1.3	1.4
overturned	-0.03605**	-.0318**	-0.0187*	-0.0199*
	(0.0181)	(0.0179)	(0.0104)	(0.0105)
years after overturned	…	-0.0009	…	0.0024*
		(0.0012)		(0.0014)
R^2	.7127	.7133	.8770	.8780
	Dependent Variable: Coefficient of Variation		*Dependent Variable: Coefficient of Variation*	
	1.1	1.2	1.3	1.4
overturned	-1.77669**	-1.0453**	-0.5790**	-0.5760**
	(.4984)	(.5243)	(0.2920)	(0.2920)
years after overturned	…	-0.0504	…	-0.0064
		(0.0361)		(0.0400)
R^2	.7412	.7430	.9030	.9040
	Dependent Variable: Theil Index		*Dependent Variable: Theil Index*	
	1.1	1.2	1.3	1.4
overturned	-0.00171**	-0.0014*	-0.0014**	-0.0014**
	(0.0005)	(0.0005)	(0.0004)	(0.0004)
years after overturned	…	-0.0001	…	0.0000
		(0.0000)		(0.0000)
R^2	.7237	.7253	.8780	.8780

Robust standard errors in parantheses
*p<.10; **p<.05; ***p<.001
Source: Panel A: United States Census of Governments F-33 Data File; Panel B: National Center for Education Statistics FNF Data File

Table 6

Fixed Effects Estimates, Effect of Equity- versus Adequacy-Based Reform on Inequality in Total Current Expenditure

	Panel A, 1972 - 2002				Panel B, 1990 - 2000			
	Dependent Variable: Natural Log of Federal Range Ratio				*Dependent Variable: Natural Log of Federal Range Ratio*			
	2.1	2.2	2.3	2.4	2.5	2.6	2.7	2.8
overturned			-0.0426**	-0.0321			-0.0618**	-0.0668**
			(0.0204)	(0.0309)			(0.01748)	(0.0181)
overturned equity		-0.0413*		-0.0147		0.0054		0.0352
		(0.0213)		(0.0326)		-0.0319		(0.0331)
overturned adequacy	-0.01309		0.0131	0.0084	0.0033		0.0470**	0.0489**
	(0.01908)		(0.0228)	(0.0252)	(0.0092)		(0.0153)	(0.0154)
R^2	0.7084	0.7119	0.7131	0.7133	0.8762	0.8761	0.8795	0.8798
	Dependent Variable:: Coefficient of Variation				*Dependent Variable:: Coefficient of Variation*			
	2.1	2.2	2.3	2.4	2.5	2.6	2.7	2.8
overturned			-1.5680**	-0.8844			-1.3682**	-1.4337**
			(0.5982)	(0.9061)			(0.4903)	(0.5079)
overturned equity		-1.6857**		-0.9588		-0.2686		0.4626
		(0.0073)		(0.9545)		(0.8913)		(0.9284)
overturned adequacy	-0.3781		0.5883	0.2753	-0.1076		0.8596**	0.8845**
	(0.5623)		(0.6674)	(0.7366)	(0.2570)		(0.4303)	(0.4335)
R^2	0.7353	0.7419	0.7420	0.7429	0.9027	0.9026	0.9043	0.9044
	Dependent Variable: Theil Index				*Dependent Variable: Theil Index*			
	2.1	2.2	2.3	2.4	2.5	2.6	2.7	2.8
overturned			-0.0020**	-0.0010			-0.0026**	-0.0028**
			(0.00087)	(0.0013)			(0.00075)	(0.0008)
overturned equity		-0.0023**		-0.0014		-0.0003		0.0014
		(0.0009)		(0.0014)		(0.0014)		(0.0014)
overturned adequacy	-0.00065		0.0006	0.00011	-0.00055		0.0013**	0.0014**
	(0.00081)		(0.00097)	(0.0011)	(0.000393)		(0.00066)	(0.0007)
R^2	0.7186	0.7244	0.7241	0.7252	0.8762	0.8757	0.8795	0.8797

Robust standard errors in parantheses

*p<.10;**p<.05

Source: Panel A United States Census of Governments F-33 Data File; Panel B National Center for Education Statistics FNF Data File

Table 7

Two-Stage Estimates, Association Between Total Current Expenditure and Students Requiring Additional Resources, 1990 - 2000

	3.1	3.2	3.3	3.4	3.5
overturned	1.7258 (2.2501)	…	…	0.0569 (4.7279)	0.527 (4.9983)
overturned equity	…	-2.0139 (2.1670)	…	…	-3.4237 (3.2450)
overturned adequacy	…	…	1.8182 (2.0672)	1.7745 (4.3301)	1.5713 (4.4042)
R^2	0.9216	0.9215	0.9217	0.9217	0.9217

Second-stage models are estimated by weighted least squares, using as weights the inverse sampling variance of the estimated correlation

Robust standard errors in parantheses

*p<.10; **p<.05; ***p<.001

Source: National Center for Education Statistics FNF Data File